$4.00 a Year Forestry MAR 16 1939 50c a Copy

VETERINARY MEDICINE

APRIL 1939

CONTENTS

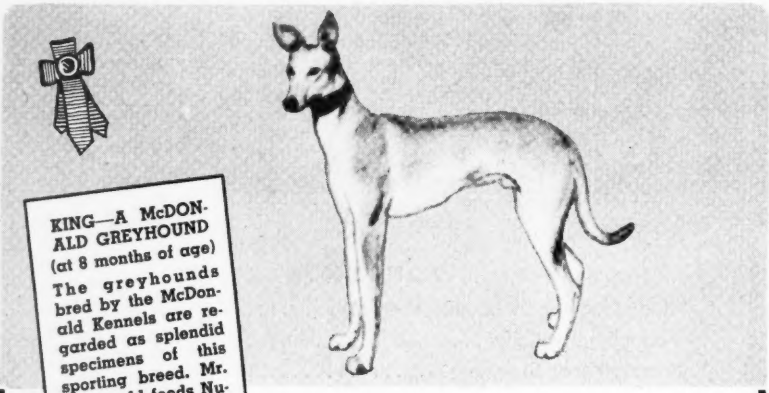
Meat Inspection Requirements....203
Vomiting in Cows....203
Principles of Breeding....204
Better Live Stock....205
Some Eastern Poisonous Plants....206
Live Stock Conditions in Montana....209
Studies on Growth and Early Maturity....212
Purulent Osteomyelitis of Mandible in a Horse....217
Care of the Broodmare....220
Spaying Foals in the Field....229
Jugular Slough Following Calcium Gluconate Injection..231
An Atypical Strain of Brucella Abortus....232
Pellagra in a Hereford....233
Anaplasmosis in Puerto Rico....234
Rickets in Calves....237
Breeds of Sheep....238
Anemia of Suckling Pigs....239
Hazards Occurring Among Garbage Fed Swine....240
Hemoglobinuria in Calves....242
Polyuria in a Cat....243
Dystocia Due to Hydrocephalus....243
Dextrose Therapy....244
Technique of Physical Examination in Small Animals...248
Chronic Fistula in a Dog....255
Canine Pediatrics....256
Abstracts....262-264

Leptospirosis in Dogs, 262; Scenting Capacity of the Dog, 262; Retention Cysts of the Salivary Glands, 263; Noma in Dogs, 263; Encephalomyelitis in Pigs, 263; Arthritis Deformans in Horses, 263; Thrombosis of the Iliac Artery, 263; Vaccination against Foot-and-Mouth Disease, 264; Treatment of Nymphomania with Pineal Extract, 264.

VOL. XXXIV
No. 4

Entered as second-class matter Nov. 8, 1920, at the post office at Chicago, Ill., under the Act of March 3, 1879.

7632 S. Crandon Ave.
Chicago, U. S. A.



KING—A McDONALD GREYHOUND (at 8 months of age)
The greyhounds bred by the McDonald Kennels are regarded as splendid specimens of this sporting breed. Mr. McDonald feeds Nutrena Dog Food.

Proved by Use . . .

The nutritional value of Nutrena Dog Food has been proved by widespread practical use. You can recommend Nutrena with complete confidence in skin and digestive disorders, in pregnancy, in convalescence, or in any other case where better nutrition is indicated. Repeated biological assays show a high level of vitamin content (A, B, D and G).

●

"MY DOGS ARE NEVER SICK"

"I never saw such well developed muscles and lovely coats. I have fed Nutrena to my dogs since they were old enough to eat and they have never been sick at all."—Everette McDonald, Wellington, Kansas.

SATISFACTION GUARANTEED

Send today for Free Sample and special proposition to veterinarians.

Nutrena DOG FOOD

Nutrena Mills, Inc. KANSAS CITY, KANSAS

VETERINARY MEDICINE

Registered in U. S. Patent Office

VOL. XXXIV APRIL, 1939 No. 4

Published Monthly by the

VETERINARY MAGAZINE CORPORATION

7632 S. CRANDON AVE., CHICAGO, ILL., U. S. A.

$4.00 a year; per copy 50 cents; Special Issues $1.00

All matter appearing in this publication is copyrighted. No part of it may be reproduced without specific permission. Permission will be given if the purpose is unobjectionable. If there be any question as to propriety of reproduction the author will be consulted.

D. M. CAMPBELL, *Editor*
7632 S. Crandon Ave., Chicago, Ill.
Telephone South Shore 7160

H. J. MOSTYN, *Eastern Representative*
1265 Broadway, New York, N. Y.
Telephone Murray Hill 4-4037

COPYRIGHTED 1939 BY VETERINARY MAGAZINE CORPORATION

Unthriftiness in calves, for which no other cause is apparent, is often due to lung worm or stomach worm infestation, or an infestation of both varieties of parasites.

Liver abscesses incident to *Endameba histolytica* infection may, according to Ochener, and DeBakey, affect from 300,000 to 600,000 persons in the United States. In addition to the liver lesion there are several other pathologic conditions that are secondary to the liver lesion.

That brucellosis in swine is far more prevalent than is commonly suspected, is revealed by the experience of a well-known breeder in Illinois, who set out to purchase a few boars from herds free of brucellosis. When the agglutination test was made, animal after animal and herd after herd were rejected.

The chick embryo vaccine has been highly successful in preventing equine encephalomyelitis. Thousands of horses and mules have been vaccinated. It seems probable that many of them will be vaccinated next spring. It is hoped that vaccination has not produced a hypersensitiveness that will result in anaphylaxis upon revaccination.—*A. T. K.*

There were 317 official dog shows in the United States during 1937 and 336 in 1938.

Minneapolis, Minnesota, has just come through a nine-months' dog quarantine because of an outbreak of rabies.

Danville (Illinois) and surrounding territory experienced the most serious outbreak of rabies in 1938 that it has known in many years.

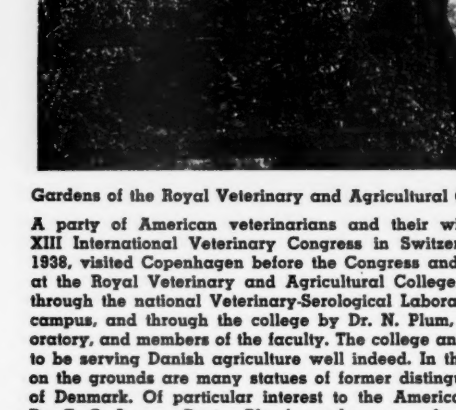
A mild infection of the udder with other types of bacteria may facilitate its infection with *Streptococcus agalactia* and a consequent attack of mastitis. Mechanical injury, incomplete milking, and chilling are believed to be other causes contributing to *Str. agalactia* infection of the udder.

Both medically and economically pneumonia is a disease attendant with serious consequences. It accounts for well in excess of 450,000 cases of illness a year in the United States, approximately 25% of which are fatal. This toll exceeds that of any other communicable disease. It also contributes to many thousands of deaths annually which are officially attributed to other causes, and the extent of this contribution has never been accurately evaluated.—*Public Health Reports.*

Gardens of the Royal Veterinary and Agricultural College of Denmark.

A party of American veterinarians and their wives enroute to the XIII International Veterinary Congress in Switzerland August 20-26, 1938, visited Copenhagen before the Congress and spent one-half day at the Royal Veterinary and Agricultural College. They were shown through the national Veterinary-Serological Laboratory, located on the campus, and through the college by Dr. N. Plum, director of the laboratory, and members of the faculty. The college and laboratory appear to be serving Danish agriculture well indeed. In the beautiful gardens on the grounds are many statues of former distinguished veterinarians of Denmark. Of particular interest to the Americans were a bust of Dr. C. O. Jensen, Doctor Plum's predecessor, whose textbook on milk hygiene a whole generation of American veterinarians studied; and a bust of Schmidt of Kolding, discoverer of the inflation treatment for milk fever, the latter erected with a fund raised by Americans.

Right: Dr. N. Plum, Copenhagen, beside the statue of Dr. C. O. Jensen.



Left: A typical Danish red cow. Contrary to the common impression in America, except in Jutland, the dairy cow of Denmark is not the holstein but the Danish red, a rugged, heavy-boned, dairy breed whose bull calves will make good veal or baby beef. Upon this breed rests the preëminence of Denmark in average annual milk production per cow. Upon it also in considerable part rests the fame of Danish bacon in the world markets, for skim milk is the principle feed of the Landrace hog, a Danish breed raised nowhere else, and in the skilled hands of Danish farmers unequalled as a producer of high class bacon at low cost.

According to old legend, the Pekinese dog is the result of a romance 10,000 years ago between a lion and a squirrel.—*S. N. L.* 34:19

About 400 dogs a year, imported into England as pets, are put through a six-months' quarantine régime to prevent spread of diseases.—*S. N. L.* 35:2.

More people in Massachusetts suffer from chronic arthritis—inflammation of joints—than from heart disease, tuberculosis, and cancer combined.—*S. N. L.* 34:21.

Two hundred fifty-six American newspapers carry astrological services to cater to the people's uneducated appetite for myth and magic.—*S. N. L.* 35:2.

Chronic arthritis is the greatest single cause of disability in temperate climates, says a physician at the University of Michigan Hospital.—*S. N. L.* 34:21.

Government scientists are working on a method of converting the lactic acid in milk into acrylic acid, which is useful in making transparent plastics that can be substituted for glass.—*S. N. L.* 35:2.

Hydrogen peroxide appears to be the substance to which sulfanilamide, new chemical remedy for a host of diseases, owes its effect, according to Drs. Arthur Locke, E. R. Main, and R. R. Mellon, of the Western Pennsylvania Hospital.—*S. N. L.* 35:2.

Wisconsin is a cattle exporting state, exporting an average of more than 40,000 cattle yearly for breeding and dairy purposes. It has exported as many as 82,000 in a year. The state exports an average of 2,000 hogs, 1,000 sheep and 700 dogs yearly.

When convulsions occur in calves that have been carried through the winter on a poor or insufficient diet, suspect rickets. The blood of such animals frequently reveals less than half the normal content of calcium.

Last year, the world production of silver fox pelts reached a total of one million.

During 1938 seven counties in Wisconsin completed the tests of all cattle for Bang's disease.

In Wisconsin there are 3,200,000 cattle; 1,300,000 swine; 500,000 sheep and 350 veterinarians.

The B. A. I. Inspector in Charge in Wisconsin reports that 20 to 25% of the abortion among cattle in the state is not connected with Brucella infection.

The total income of fur farming industry in the United States for 1937 was $7,000,000. Of this amount, $4,500,000 or 64% was received by Wisconsin fur farmers. Wisconsin also produced 45% of the farm raised mink pelts marketed during 1937.

Sex can be determined as male or female at the will of the experimenter, in tadpoles of a race of bullfrogs, by the injection of hormones or gland products, Dr. William O. Puckett of Princeton University demonstrated before the American Society of Zoölogists.—*S. N. L.* 35:2.

Fifty thousand worn out horses annually find a market among the fur farmers of Wisconsin. In addition, the fur industry is a large user of beef and other meat products, and of large amounts of fish. Cereals and milk constitute one-fourth of the ration of farm-raised fur-bearing animals.

During the 1938 outbreak of equine encephalomyelitis in Wisconsin, the Governor of the state was deluged with requests from quacks and neighborhood handy men for permission to obtain and use the chick vaccine. The Department of Live Stock Sanitation rejected all such applications, but was embarrassed later to find that several veterinarians had employed these handy men to do vaccinating for them and a few had supplied others with an ample stock of the vaccine. Several of the latter were prosecuted for using the vaccine.

Hardly any other tissue of the organism reacts so readily to all possible external and internal influences as do the testicles.—Lagerlöf.

* * * *

In contradistinction to renal uremia, which primarily is caused by a chronic interstitial nephritis, the extrarenal uremia is caused by retention of urea-excretions and diminished urine secretions.—*J. Fooy.*

* * * *

A large percentage of wild birds are infected with a plasmodium that is mosquito-borne. Eight species of avian plasmodium have been identified and 30 North American species of birds harbor at least one of these species. Avian plasmodium is transmitted by a culicine mosquito.—*Exp. Sta. Rec.* 79:3.

* * * *

Prolan, a gonadotrope hormone of the anterior lobe of the hypophysis is closely related to the proteins. The inactivation of prolan by means of peptolytic ferments lends plausibility to this view. At the present time the animal experiment remains the sole method for the evaluation.—*H. Weyland and K. Döttler.*

* * * *

Oxyuriasis is, usually, considered a harmless infestation in horses. Severe infestation, however, may cause symptoms of anemia. But even a slight infestation is apt to annoy the animal on account of the intense itching in the anal region.—*O. Wagner.*

* * * *

Fifteen hundred and fifty-seven stallions and three jacks were registered by the Stallion Registration Board of Minnesota during 1938. Of the stallions, 1504 were purebred, 53 grade. Thirty years ago the number of purebred stallions registered in the state was 1009 and of grades, 2642. By 1912 the purebred stallions had increased to 1722 and the grades to 2745, a total of 4467, the highest number ever registered. From 1912 to 1932, the number decreased and in the latter year, was 1066 purebred and 1204 grade. Since 1932 the number of purebred stallions has increased 50%; but the grades have almost disappeared.

According to the literature, a great variety of animals are susceptible to pseudotuberculosis. It has been described in the horse, cow, pig, goat, rabbit, hare, cat, guinea pig, wild rat, hen, and monkey.—*P. H. R.*, 53:31, p. 1340.

* * * *

B. pseudotuberculosis rodentium (Pfeiffer) is capable of infecting man, resulting in a clinical disease of fever, vague abdominal tenderness, and jaundice. At autopsy numerous greyish white nodules are seen throughout the liver.—*P. H. R.*, 53:31.

* * * *

The virus of canine distemper has a definite affinity for vascular endothelium and for cells of the reticulo-endothelial system. The virus spreads in the body of the host mainly by way of the blood stream. The natural route of infection is by way of the respiratory tract.—*Am. Jour. Path.*, 1937.

* * * *

The German Breeding Act of 1936 provides: The official veterinarian of each district must be present at each selection of a breeding sire to examine the animal for constitutional defects and hereditary weaknesses, as well as for the state of its health.

* * * *

The National Poultry Improvement Plan has been developed to assist the poultry industry in placing itself upon a more sound and efficient basis. This is being accomplished through (1) the development of more effective state programs for improving the production and breeding qualities of poultry and reducing mortality from pullorum disease; (2) the authoritative identification of breeding stock, hatching eggs, and chicks with respect to quality, describing them in uniform terms; and (3) the establishment of an effective coöperative program through which the best results from scientific research can be applied immediately to the improvement of poultry and poultry products. In 1938, nearly 30,000 flock owners in 44 states, including nearly 300 U.S.R.O.P. breeders, and nearly 1,500 hatcheries operated under the plan. The flock owners had about six million breeding birds and the hatcheries had a total capacity of about 60 million eggs.

Meat Inspection Requirements

A number of states are seriously considering the inauguration of state-wide meat inspection. Of course, a number of problems other than the establishment of an inspection department as a part of the state board of health or state department of agriculture are involved in such an undertaking. Probably the most serious of these problems is the practical rebuilding of the local slaughtering establishments. The general public may be expected to approve measures for improving the quality of its food supply and live stock producers can be depended upon to favor meat inspection when they are convinced that it will increase the consumption of meat. Local slaughterers, on the other hand, may be counted upon to strenuously oppose any regulation and particularly any legislation that will impose upon them material construction costs. The following essential features to be provided in plants adequate to the requirements of meat inspection show that the cost of transforming the majority of local slaughter houses into sanitary establishments is indeed material. They are given by Dr. E. C. Joss, Chief of the Meat Inspection Division of the federal Bureau of Animal Industry:

1. Adequate supply of potable water; sufficient hot water under suitable pressure for cleaning purposes; and sanitary sewage disposal.
2. Impervious well-drained floors wherever frequent cleaning is necessary; impervious, smooth and flat side walls; smooth and flat ceilings; and properly trapped and vented plumbing system.
3. Means for admitting an abundance of direct natural light and ventilation for workrooms not under refrigeration.
4. Proper separation between compartments used for edible products and those used for inedible products.
5. Fly screens for all outer openings and, so far as possible, ratproof construction.
6. Dressing and storage rails of such height and so spaced that carcasses and meats do not contact floors, walls or posts.
7. Rust-resistant metal equipment so far as practicable; and equipment to keep meats, heads, viscera and condemned and inedible material from contacting the floor.
8. Convenient lavatories for washing hands and arms in running hot and cold water connections.
9. Modern type toilet rooms and dressing rooms.
10. Livestock pens, alleys and drive-up chutes and vehicular loading and unloading places where meat is handled, paved with brick or concrete.
11. Means for disposing of inedible and diseased material without creating a nuisance and without spreading disease.

Vomiting in Cows

I am bothered with vomiting in cows, a condition which I cannot find in the text books. What is the cause and treatment?—*T. D.*

Comment.—Dr. S. L. Stewart of Olathe, Kansas, reported three cases of vomiting in this magazine (*Vet. Med.* 32:9, p. 410). They may be summarized as follows:

Case No. 1.—A yearling, white-faced steer, grazing on fresh green grass, persistently ejected its cud after partly filling the rumen. Autopsy revealed that it had swallowed some sharp object that cut a slit in the mucous membrane of the lower part of the esophagus, and a fibrous proliferation of the fascia had involved the left vagus nerve.

Case No. 2.—A Jersey cow presented the same symptoms, and autopsy disclosed the same lesions.

Case No. 3—The same symptoms were shown by a two-year-old Jersey bull. A stomach tube when passed encountered an obstruction. With considerable difficulty, and marked objection on the part of the bull, Doctor Stewart forced the tube on into the stomach, dislodging the obstructing object. The bull refused to eat for several days, although it drank water, and it was weeks before it ate normally; but it made a complete recovery.

In more than 30 years of practice Doctor Stewart has encountered only six cases of vomiting in cattle; in every case he has found a foreign object in the esophagus (or the trace of one) near the rumen, or in the pillars of the esophagus. He is therefore of the opinion that vomiting in cattle is caused by the ingestion of a foreign body, such as a wire, nail, or piece of glass, which becomes lodged in the esophagus or that possibly a new growth in this region might cause it.

Principles of Breeding

Controversies long have raged as to the relative or the different influences of the sire and the dam upon the puppies. Views are frequently heard expressed that one is more important than the other, or that the sire is responsible for some qualities and the dam for other qualities.

A clear understanding of the facts is essential to every breeder. It is plain that he cannot accomplish much if he is working on an incorrect assumption that the dam will give him control of certain qualities, and the sire of others. If his premise is not sound, it is not to be expected that his accomplishments will be satisfactory.

It is well, therefore, to look at the matter in a dispassionate manner, and from a scientific viewpoint. If some qualities are to be controlled by one parent and some by the other, we would have to deal with what is known as sex-linked qualities. These must not in any way be confused with sex-limited qualities, such as the egg-laying quality of hens or milk-producing quality of cows; or of those differences and refinements of nature which distinguish the female from the male of every species.

Sex-limited qualities are those which can be exhibited by the individuals of only one sex. Sex-linked qualities are those which can be transmitted from one generation to another by the individuals of only one of the two sexes. An easily discernible example of the rare sex-linked qualities is the bleeding disease of some royal families of Europe. This disease is known to be hereditary. It is found only in the men, the women not being affected by it. The disease is carried, however, by the mother and transmitted from her to her sons. Although it does not affect the mother, the sons may show its effects. The fathers, though they may have the disease, are incapable of transmitting it to their children.

Another example is the barring in the coloring of the cockerels of the barred-rock breed of chickens. This barring has been proved to be sex-linked and to be transmitted only by the hens.

Sex-linked qualities are very rare in so far as science knows them today. So far as is known to science, no sex-linked qualities in dogs have ever been discovered.

Without the isolation of such sex-linked qualities it must be granted that each parent influences each quality of the puppy, and that no power can be granted to one of the parents on account of its sex to have a greater influence over any one quality than is granted to the other parent.

As we look upon the production of the complete puppy as representing a combined partnership effort of the two parents, so we must look upon each individual quality of the puppy as being produced in the same way.

Having disposed of the relative influence of the two parents in so far as different isolated qualities are concerned which may be due to their sex, we are next called to face the problem as to whether the difference in sex accounts for any difference in the force of the heritage which they transmit to their offspring. Biologists now stand united with leading practical breeders in the opinion that the sire and dam may be equally prepotent for any quality and for the composite of all qualities, and that no difference exists due to the sex of the parents. In so far as sex is concerned the parents may be equally prepotent or either may be prepotent over the other for any quality, or for all qualities.

It all depends upon which of the parents carries a store of hereditary materials making it prepotent over the other parent for any particular quality, or for a composite of the greater number of important qualities. It simply depends upon which of the parents is the better breeder for the qualities we are seeking.

In the average mating, the sire proves to be prepotent over the dam simply because it is usual for bitches of unproved producing powers to be bred to dogs which have already been tested and have proved their prepotency. That is to say, in the average mating the sire is the better breeder of the two. When a bitch has proved herself to be a successful producer, it is natural to breed her to one of the proved

sires, and it is very unusual to breed her to a dog whose producing powers have not been tested and proved to be far above the average.

If the positions were reversed and a bitch with known powers to impress her offspring strongly were bred to a dog of just average breeding powers or of untested breeding powers, then the bitch could be expected to be the more prepotent of the two parents.

Regarding the sexes as equally prepotent in so far as a single mating is concerned, it is yet clear that, on account of the greater number of his offspring, the prepotent sire exerts a much greater influence upon the breed and strain than does an equally prepotent dam.

A dam which produces ten winners may, on account of the limited number of her offspring, be considered one of the exceptionally prepotent dams of her breed. A sire, with his much greater number of puppies, would certainly be required to produce upwards of forty winners before he could be considered as equally prepotent as such a dam. The great sires are, therefore, clearly seen to be responsible for the qualities of a breed as a whole to a far greater extent than are the great dams.

The answer is simply that the one which will be prepotent for any quality depends upon which one has the strongest heredity for this quality to be passed on to its puppies. In most matings this is the sire instead of the dam, because it will be found that a dam of unproved breeding powers is being bred to a tested and proved sire.

However, when it comes to producing the real tops of every breed—the great winners and the great producers—it is usually found that they come from a very strong partnership, a great breeding dam mated to a great sire. The individuals bred in this way are usually the ones which carry the lines of ancestry down from generation to generation, and appear most frequently in the pedigrees of the winners.—*James C. Foster Jr.* in *The American Field* 131:1 (Jan. 7, 1939).

Many live stock communities of the Northwest are seriously handicapped by the lack of efficient veterinary service. Where qualified veterinarians are unable to establish successful practice, it is necessary that the state give special assistance, in the nature of state work, to local veterinarians to develop a profitable live stock industry in such sections.—*Live Stock San. Com.*, Sioux City, Iowa.

Better Live Stock

Better live stock means not only animals of better blood lines, but animals of stronger vitality, freer from disease and more capable of adapting themselves to climatic and feeding conditions.

In the past we have been prone to consider the words "better live stock" as applying only to better blood lines. From an economic standpoint it is just as essential that animals be freer from diseases, have more vitality and be more capable of adapting themselves to feeding and climatic conditions of the country in which they are being raised as it is for them to be bred along better blood lines.—*W. J. Butler*, at annual convention of Montana Stock Growers Assn., April 20-21, 1920.

THE K. K. K. AT THE UNITED STATES LIVE STOCK SANITARY ASSOCIATION

Left to right: Mr. H. G. Ketchum, Luzerne, N. Y., president, Ketchum Manufacturing Company; Mr. J. Orme Ker, manager of the Canadian Branch of the Ketchum Manufacturing Company, Ottawa, Ont., and Dr. J. S. Koen, Storm Lake, Iowa.

Some Eastern Poisonous Plants

By A. B. MASSEY, Blacksburg, Virginia
Department of Biology,
Virginia Polytechnic Institute

LIVE STOCK, hungry for green food, may browse on evergreen shrubs and other plants during the winter season where there is a scarcity of grass in the pastures. Some of the most common of these plants are dangerously poisonous and are responsible for considerable loss at this season of the year. Sheep and goats seem to suffer more from this poisoning than other forms of live stock, largely because they are more liable to browse on such plants. Deer and other forms of wildlife are not so susceptible to these poisonous plants as are the domestic animals, but they also may become ill if they eat heavily of them. In over-stocked areas or in time of prolonged snow-covering, when deer are forced to browse heavily on evergreen shrubs they are more liable to suffer from poisoning.

THE most dangerous native evergreen shrubs are the mountain laurel and the rhododendron. Mountain laurel, also called ivy-bush (*Kalmia latifolia*) is one of the most wide-spread evergreen shrubs in this state. It is common from the coast to the westernmost tip of the state, but is most abundant in the upper Piedmont and mountains. It is especially poisonous and gives the stockmen considerable trouble. It commonly grows in thickets in cool woodlands, but is frequently found in the open on cool slopes or moist areas where the trees have been removed. Laurel is one of the most attractive native flowering shrubs we have and should not be destroyed, but stock should be fenced away from it in the winter when grass is scarce. Another species of laurel called sheep laurel (*Kalmia angustifolia*) occurs in open swamps in the coastal region. It is very poisonous, but is not a common plant.

Rhododendron, also called great laurel, is poisonous in the same way as mountain laurel in that they both contain much the same poisonous substance. The rhododendron is not as wide-spread over the state as the mountain laurel. It is mostly confined to the mountain region where it occurs in great masses on or at the foot of cool, wooded slopes, where the soil is moist. There are at least two kinds of native rhododendron — *Rhododendron maximum* and *R. catawbiense* and a number of other evergreen types are to be found in ornamental plantings, all of which poison animals that eat the leaves. Like the mountain laurel, rhododendron is highly prized for its handsome flowers which appear in the summer and for its general ornamental value. Hence, these bushes should not be destroyed to prevent the poisoning, but during the winter stock should be fenced away from them as before stated.

The closely related mountain fetterbush contains the same poisonous substance as the laurel and rhododendron. It is not widely distributed in the state and occurs on the type of land which is not so likely to be included in pastures. It may occur on wooded shale slopes on large boundaries, but since live stock are not attracted to these areas as a rule, this bush is not so likely to be browsed.

The shrubs mentioned in the foregoing are poisonous to sheep, goats, cattle, and horses. The nervous system is affected and the animal suffers from nausea and slight but prolonged vomiting and frothing at the mouth. Respiration is irregular. The pupils are dilated, and the resulting loss of sight causes the affected animal to stagger. Paralysis may develop, accompanied by drowsiness and finally death. The severity and extent of the symptoms are governed by the amount of leaf material eaten.

SOME of the evergreen shrubs which are not native but are planted to beautify our yards and grounds are poisonous to stock, and to children as well. The highly prized box, commonly planted in hedges or used as a shrub, contains a poison in its leaves and stems. The leaves and twigs are bitter, hence the animals are some-

what restrained from eating the plant. All live stock are subject to the action of the poison, but pigs seem to be more readily affected, probably because they eat some of the roots as well as the leaves on the ground. Small amounts of the plant cause nausea and purgation; larger amounts in addition cause nervous symptoms, lameness, muscular tremors and vertigo, followed by coma. Large amounts cause death with intense abdominal pain, convulsions, and respiratory distress.

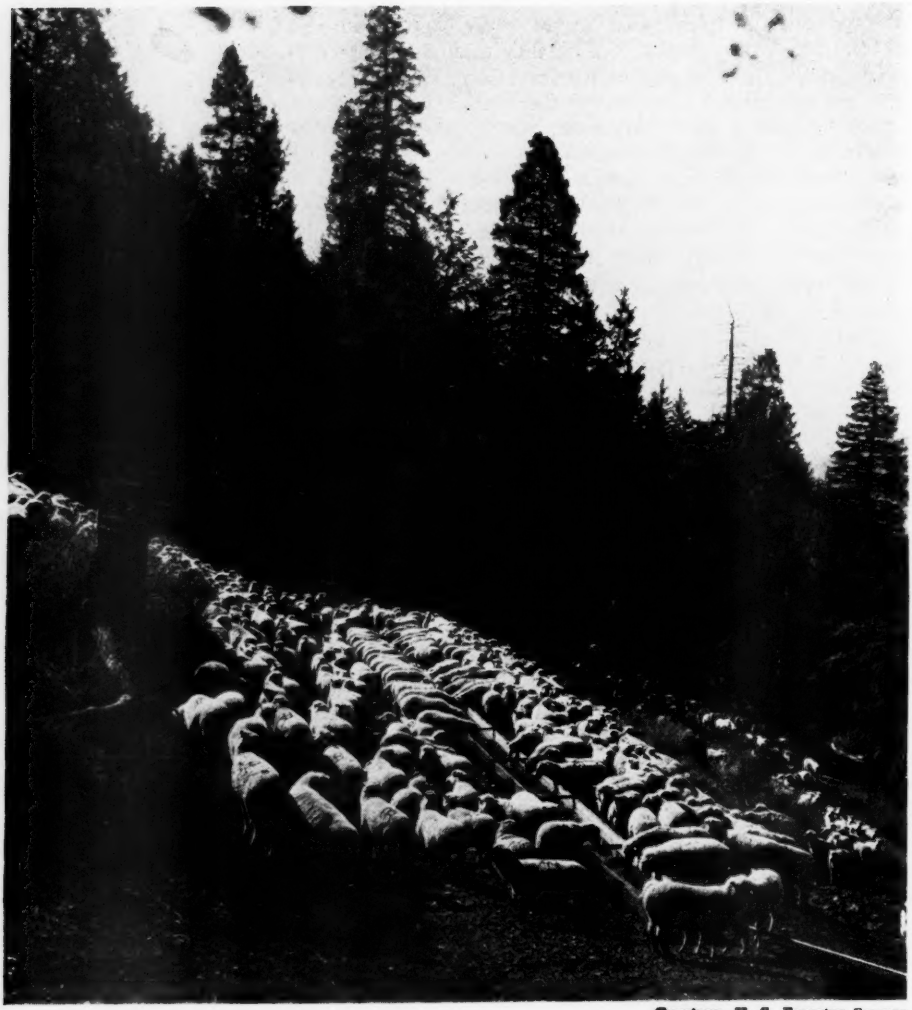
The yews also contain substances poisonous to stock and children. These are shrubs which look like a very green glossy-leaved hemlock. Animals suffering from yew poisoning often die suddenly without showing marked symptoms. When the plant is eaten in small quantities there are pronounced symptoms of excitement, followed by nausea and vomiting (where possible), slackening of respiration, circulation, and lowering of temperature. The poisonous substance is irritant and narcotic in action.

There is a native species of yew also, (*Taxus canadensis*) in Virginia, but it is very rare. It has been reported from Wythe, Smyth, Montgomery, and Highland counties. These ornamental evergreens are not pasture problems unless they are thoughtlessly planted by the pasture or barnyard fence or clippings thrown where stock have access to them. The stray animal may get to them and be severely poisoned.

CAPER'S spurge (*Euphorbia lathyrus*), or sassy Jack as it is called in the mountains, is a naturalized herbaceous plant in parts of Southwest Virginia. This belongs to the so called winter annuals. It starts from the seed in late summer and lives as a green plant throughout the winter, flowering the next summer. This spurge has been used for ornamental planting in yards and is usually found in rocky soil, especially among boulders, near old home sites. In the winter the plants are from a few inches to two feet tall. The leaves are narrow and pointed, dark green in color, with a white line running the length of the center. They are crowded on the stem and appear to be in four rows up the stem, the younger leaves at the top stand erect, protecting the tender bud. The juice of the plant is milky and sticky. It is poisonous to live stock in general, but is especially dangerous for sheep. Other animals do not eat it as readily as sheep. It is said that the poison is eliminated in the milk of cows which have eaten the plant, and that such milk causes an irritation to the digestive tract of man and a purgative action. The milky juice of the plant contains a very irritating substance which affects the lining of the mouth and the digestive tract, causing vomiting and intense diarrhea with nervous disorders, collapse, and frequently death. This plant is of no value and should be destroyed wherever it occurs. Home plantings should be discouraged in sheep raising sections.

Snow-on-the-mountain is a spurge commonly planted in yards for ornamental purposes. It is poisonous, having the same action as Caper's spurge, but is not a factor in winter poisoning as it dies down when winter comes.

ANIMALS suffering from poisoning must be treated promptly. The following treatment is recommended by Dr. L. E. Starr. In any case of suspected poisoning call a veterinarian immediately, as in many cases it is desirable to empty the stomach by the use of a stomach tube. Symptomatic treatment such as heart stimulants and intravenous injections of glucose are necessary in severe cases to sustain the animal until the system can neutralize or eliminate the poison. These treatments cannot be given by the owner. Since delay may be fatal, the owner should give the following treatment, if a veterinarian cannot be secured at once. Drench the animal with raw linseed oil (sheep 4 ounces, larger animals one quart). Follow this treatment by drenching three times a day with strong coffee as hot as the animal can stand; (giving sheep one pint and larger animals one quart). If the mouth of the animal is irritated and inflamed, the coffee should be luke warm. Give the animal



Courtesy, U. S. Forestry Service

Sheep on Summer Range in Sawtooth Mountains, Southern Idaho.

plenty of milk and feed it soft non-irritating food. Keep it as comfortable as possible and protected from the cold ground and weather. If this treatment is begun in time, the affected animal will have a chance of recovery.

The most important and economical practice is to prevent sickness and losses by keeping the animals away from poisonous plants in the winter season when there is a scarcity of food and in periods of severe drought.

Live Stock Conditions in Montana*

Montana is practically free from bovine tuberculosis. In 1937 we had to pay only $54.77 in indemnities for tuberculosis; in 1938 only $29.21. Twenty years ago we paid $32,619.84 in indemnities for tuberculous cattle, and in 1919 $20,890.26. During the year 1938, in coöperation with the United States Bureau of Animal Industry we tuberculin tested 40,013 cattle. Out of this number 15 reacted to the test—0.037%.

There were no cases of glanders or of dourine reported in Montana during the years 1937 and 1938. Distemper was not as prevalent during 1937 and 1938 as it was in 1936.

During 1937 there were 743 cases of encephalomyelitis in 34 counties in Montana. The death loss was approximately 33.5%. In 1938 there were 11,840 cases of encephalomyelitis in 53 counties with 4,213 deaths —35.5%†.

A number of years ago swamp fever was diagnosed in several sections of Montana. The disease seemed to become quiescent and was not reported or observed for many years. Five years ago it was observed in two districts and has been observed each year since then in these two districts. Apparently it has not spread, although the disease as in the case of encephalomyelitis, is presumed to be transmitted at times through the bite of insects and to be carried by infected animals and probably by birds to new districts. Acute cases of swamp fever have been wrongly diagnosed in one or two instances as encephalomyelitis.

Indemnity for animals destroyed by order of the Livestock Sanitary Board is paid out of funds derived from a special tax on live stock. Montana is the only state in the United States where the stock men pay indemnity themselves. In all other states indemnity funds are derived from the general fund of the state.

We are in harmony with the coöperative Bang's disease program which requires blood testing of herds and the slaughter of reactors when such a program is confined to individual herds or to certain designated areas where such testing can be carried on in an economical and practical manner. We are, however, opposed to compulsory blood testing and slaughter of all reactors in range and semi-range herds.

We are of the opinion that there is no one best and only method to be followed blindly in all instances in the control of Bang's disease. Professional judgment must be used and the most applicable and practical method followed as the individual herd, case or the area warrants. Calfhood vaccination, when confined to calves between four and eight months of age, with a vaccine prepared from a virus of low virulency, in our coöperative work, has proved a safe procedure.

Experience has taught us that in range and semi-range herds, Bang's disease may be controlled and eradicated by proper herd management, together with an annual fall test, and the vaccinating of breeding calves four to eight months of age. In such herds we are of the opinion that more good can be accomplished by an annual fall chute test (with the immediate shipment of reactors to market), together with calfhood vaccination and proper herd management, than can be accomplished by repeated blood testing.

---

*Selected paragraphs from the biennial report of the Montana Livestock Sanitary Board for 1937-1938.

† In the whole state of Montana (146,997 square miles in extent and with more than five million head of live stock) there are but 40 qualified veterinarians engaged in practice. It should be noted that last year the average mortality from encephalomyelitis was 21% for the whole country but 35.5% for Montana. Lack of veterinary attention for stricken animals is the most plausible explanation of why the mortality was 75% higher in Montana than in states with a more adequate veterinary service. This is just one of many red-ink items the live stock industry of Montana must enter in its ledger yearly because it has not made veterinary practice attractive in that state. Montana ranchers are notably skilled and resourceful animal husbandmen, and the state has a phenomenally efficient Livestock Sanitary Board and corps of field veterinarians; but 40 practitioners can't be spread over 146,997 square miles, and there can be no adequate veterinary service in any state without a sufficient corps of practitioners.—Ed.

During the year 1938 we found hog cholera on 84 premises. The increase in hog cholera during the year was due to the importation of hogs from out-of-state sale yards and where the hogs had not been properly vaccinated, and to feeding uncooked garbage containing infected pork scraps.

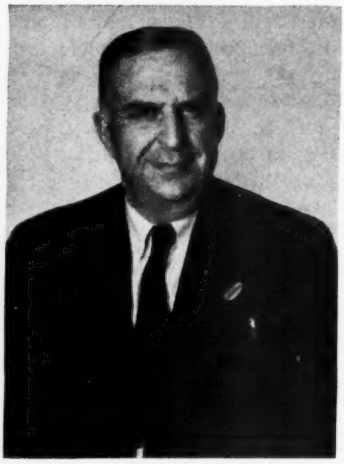
It would appear that in quite a number of states, sale yards have been established which are not under proper state or federal veterinary supervision. Sale yards without proper supervision may become a menace to the live stock industry. Here are gathered animals from hither and yon, many of which may be diseased. If they are permitted to be sold and distributed without proper veterinary supervision, then undoubtedly disease will be spread.

Trichinosis in the human family was reported by the State Board of Health to this Department. Investigation showed that 37 persons and 14 hogs were affected. That the disease might be immediately eradicated the Livestock Sanitary Board purchased all the remaining hogs in order that a proper post-mortem examination might be made and all affected carcasses burned.

Trichina infection is most commonly found in garbage-fed hogs. We have, for the past 20 years, protested against the indiscriminate feeding of collected garbage to hogs. We recommend now, as we have in the past, a law requiring that all collected garbage, that is to be fed to hogs, be cooked, or all pork scraps removed, before it is fed.

It may be interesting to note that the kidneys in elk are not lobulated; neither is there a gall-bladder. The brain is not quite as large as that of the domestic cow, but the folds are deeper and give more brain surface.

This Department has carried on extensive research work in the study of fowl leucosis during the past two years. Our studies have led us to the belief that nutrition is a very important factor in the prevention and cure of fowl leucosis. We have been able to prevent it to a great extent and to cure it in some cases by the addition of



Dr. W. J. Butler, Helena, Mont., Secretary and Executive Officer of the Montana Livestock Sanitary Board; State Veterinary Surgeon; Director of Laboratories

cod liver oil and wheat germ oil to the base rations of the flocks.

We are of the opinion that the milk supply of Montana is, as a whole, equal to, if not better than, that of any other state in the Union. Careful dairy inspection and careful examination, tuberculin tests and Bang's disease tests, are made by this Department of cattle in dairies supplying milk or cream for consumption as such. Milk samples are taken regularly from dairies in the various sections of Montana and forwarded weekly to the Livestock Sanitary Board laboratories at Helena for examination and test. Reports of the laboratory findings are mailed back to the veterinarian sending in the milk samples and he in turn delivers the original report to the owner of the dairy and sees that any defect in the operation of the dairy as disclosed by laboratory findings, is immediately remedied.

In 1937 the Livestock Sanitary Board issued 780 dairy licenses and 40 milk plant licenses; in 1938, 957 dairy licenses and 43 milk plant licenses.

In 1937 the Livestock Sanitary Board issued 56 and in 1938, 38 slaughterhouse licenses.

Montana has a splendid meat inspection law and the Livestock Sanitary Board is authorized to establish meat inspection and meat grading in any municipality where conditions warrant. However, the legislature has never appropriated money for the establishment of meat inspection. In our budget for the coming biennium we have requested a very limited appropriation in order that a meat inspection supervisor might be employed to establish proper meat inspection, similar as possible to that of the United States Bureau of Animal Industry on a free basis in municipalities requesting such inspection.

Many serious cases of live stock losses occur annually from arsenic, and to a lesser extent from strychnine poisoning.

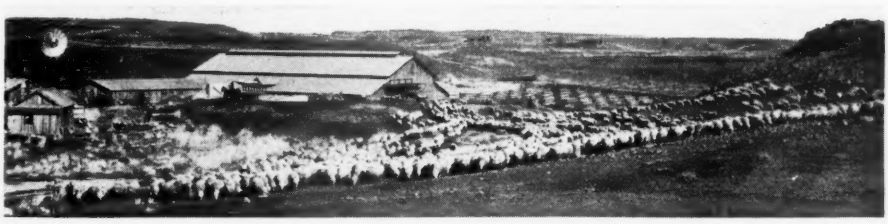
The handling of such poisonous substances in wholesale quantities by careless and unscrupulous persons results in the loss of thousands of dollars annually to live stock owners; many cases of apparent malicious poisoning are disguised under the pretense of ignorance and carelessness in handling poisonous substances.

Under the present laws it is next to impossible to convict a person of spreading poison with malicious intent and the live stock owner has very little means of obtaining recompense for losses incurred either through the careless handling of a poison or through malicious intent.

It appears to us that the state, county, or federal agency that issues a poison, is a party to all cases of live stock losses therefrom, and that the state should protect the live stock owner to the extent of prosecuting all cases wherein live stock are lost from either malicious poisoning or careless handling of such poisons by others than owners of the live stock involved. Such guilty person should be forced to recompense the owner of the live stock for the loss; but in the case a guilty person cannot be apprehended, or such person is not financially responsible, the government agency issuing the poison should recompense the owner for such loss.

It seems to us that a law covering these points would materially lessen malicious poisoning of live stock and would make it mandatory on distributing agencies to use the utmost care to prevent issuing poison to irresponsible persons or without proper instructions for its handling and disposal. It might even necessitate the filing of a surety bond by every person to whom poison was issued, and certainly such action is justifiable when one considers the menace to innocent persons.

A few cases of serious losses of live stock are reported each year which incriminate oat hay and oat straw. Such feed is generally considered to be good feed for live stock and in many cases of such losses the entire stacks have subsequently been fed without further losses. Every attempt to extract a poisonous substance from the stomachs of dead animals, or from the feed remaining in the stacks or feed lots after such losses, has met with failure. It has been our observation that the losses are caused by overfeeding of oat hay or straw to animals which have not been accustomed to it as a feed. Apparently when animals are started cautiously on oat hay or straw such losses do not occur. The problem is one which deserves more practical feeding tests and laboratory research.



Studies on Growth and Early Maturity*

By GEORGE H. HART, Davis, California,
Division of Animal Husbandry,
University of California

THE PROBLEM of growth involves phenomena so basic in the field of physiology, its allied sciences, and applied fields, that a wide variety of biologists have become intrigued with the various ramifications of the subject.

The combined attack by so many workers on so broad a front is bringing to light a better understanding of the principles involved in both embryological and post uterine growth. From this basic knowledge the practical application in the fields of animal husbandry may be on the brink of reaping rich rewards. Such studies result in definite explanations of advantages or disadvantages of methods more or less long established in husbandry and arrived at by the trial and failure method. Wide differences of opinion will always exist regarding practically all such procedures until definite explanations are available through factual information arrived at by scientific approach through biology and sciences basic thereto.

Embryological Growth

The epochal work of Spemann[1, 2] and Spemann and Mangold[3] in elucidating cell differentiation in the developing embryo through the medium of so-called organizers is of first importance. This work was done with salamanders and in transplanting a particular portion of the embryo of one species (*Triton cristatus*) into the ectoderm of the embryo of another (*Triton tæniatus*) when both were in the early gastrula stage two embryos developed in the latter which otherwise would have produced but one. Spemann used the term "organizer" for the cells producing this change and the term "organization centre" for the dorsal lip of the blastopore which was the location of these cells in the developing embryo. They studied the localization of the organizers in the embryo and demonstrated the intrinsic cause of differentiation to be contained in some cells while other cells are induced to manifest the differentiation. Thus in certain frogs, epidermis from most any part of the body when transplanted over the optic cup would produce a crystalline lens while the normal epidermis in this region will not do so if the optic cup is removed.

In other species of frogs only the normal epidermis will produce a lens and it will proceed to do so even after extirpation of the optic cup. During development there is a change from lability to finality in all the cells. The period of reactive state between the phases when the cells are too young to be acted upon and when they have become already determined was named by Waddington[4] in his work with birds the period of competence. During this reactive or lability period the ether soluble substance termed by Waddington et al[5, 6] the evocator to emphasize the fact that its function represents only one part of the whole process of embryonic induction may be suppressed by deficiency in essential dietary factors. This must be prolonged over a sufficient period for the pregnant mother to have exhausted her reserves of the particular substance. Thus vitamin A deficiency in sows has been shown by Hale[7] to prevent the formation of eyeballs in the developing fetuses if brought to a sufficiently advanced stage at the proper time in gestation when the eyeballs are being formed.

Carried beyond this stage in practically all mammals growth of the fetus will cease, death result and abortion occur. Hart and Guilbert[8] have shown this to be a cause of abortion in range cattle on ranges having a wet and dry season, when the end of pregnancy coincides with the end of a long dry period. Mason[9] has shown in the rat that fetal death from vitamin A deficiency occurs through alterations in the epithelial cells of the maternal placenta which always precedes alteration in the fetal tissue from lack of proper nutrition. On the other hand

*Read at 13th International Veterinary Congress, Zurich, Switzerland, Aug. 25, 1938.

in fetal death from vitamin E deficiency degeneration of fetal tissues occurred first, followed later by changes in the decidua.

Post Uterine Growth

A quite different angle to the general problem has been the efforts to explain the marked differences in adult size of races within a species. Differences in cell size between small forms such as the mouse as compared to the largest of mammalian species are so slight as not to be detectable by ordinary means if they actually do exist. Donaldson[10] has shown in the rat that exercise increases the weight of the musculature and some organs, the thyroid gland and liver being exceptions. This increased weight is mainly due to increase in cell size.

Painter[11] has shown that no discoverable difference exists between the cell size of embryos of Flemish, a very large race and Polish, a very small race of rabbits. Castle and Gregory[12] have shown that there was a difference in the rate of growth of fertilized eggs of these two races but that differentiation was at the same rate. Forty-eight hours after copulation the average number of blastomeres per fertilized ovum for the small race was 14 and for the large race 21.75 which occurs of course before endocrine activity can be an influence. The higher development rate could be influenced by the sperm as well as the ovum which it fertilized and genes might be involved. Castle[13] has pointed out that evidence for such an inference is at yet incomplete.

Hammett[14] has carried on extensive studies to support the hypothesis that the sulphydryl group is the essential chemical stimulus to growth by increasing cell division. Accelerated cell division was experimentally produced in paramecia and root tips when culture medium was used containing one part of sulphur as sulphydryl in ten million parts of the culture solution. This principle has been successfully used in the healing of refractory sores and wounds in animals and man with thiocresol while cresol had no such effect. In a series of papers Gregory and Goss[15, 16, 17, 18] have reported protracted studies of Hammett's hypothesis, and have come to the conclusion that at least one of the important biochemical substances involved with the regulation of body size is the concentration of glutathione in the body tissues.

Among the elaborate control of body activity functions of the anterior hypophysis, growth regulation is not the least important and methods for measuring the action of the growth hormone have been outlined by Evans and Simpson[19]. When this procedure is carried out with rats Goss and Gregory[20] have shown a decrease of 30% glutathione in the liver eight hours after a single injection of the growth hormone and 55% reduction after 12 hours. If the injections of the hormone are continued five days and the animals killed eight hours after the fifth injection there is a reversal of the concentration. The liver glutathione is found to be about normal while there is an increased quantity in the muscle. These experiments show an intimate correlation between the hormone and glutathione concentration occurring concurrently with the stimulation of increase in weight.

Lee and Schaffer[21] presented data that the composition of growth induced by the growth hormone is true growth in that treated animals retained almost exactly their initial composition in all constituents and in the heat value of their tissues.

Patrusev[22] has studied the blood concen-

Growth induced by the growth hormone is true growth. Formerly spaying beef heifers was considered preferable to breeding them before putting them into the feed lot. Spaying is going out of practice in the western range country of the United States. Observational data of recent years have not supported traditional evidence of its value. These data are substantiated by recent hormonal evidence. "Settling" heifers going into the feed lot for finishing has more behind it than stopping the disturbance of animals in heat.

tration of glutathione in several breeds of cattle and sheep in Russia. He reported that animals with higher glutathione content are as a rule larger in size and heavier.

With pure bred white leghorn and Rhode Island red chicken embryos 72 hours, 14 and 19 days of age respectively, Blunn and Gregory[23] found that a study of cell size, number and rate of mitosis showed a difference in rate of cell proliferation and embryonic development favoring the larger race. Gregory, Asmundson and Goss[24] then obtained evidence that between barred Plymouth Rock and white leghorn embryos the corrected glutathione concentration of the larger Rock embryos was slightly but consistently greater than that of the leghorn embryos through the 5th to 19th day of the incubation period.

The propensity of fetal tissues to be acted upon by evocators has its counterpart in extra uterine life in the action of certain hormones. These tend to increase cell activity and cyclical growth in special tissues over which their specific action is manifested. Examples of this are the action of sex hormones on the female sexual cycle. Superovulation has been repeatedly demonstrated by the use of gonadotropic preparations. The problem of superfecundity and superfertility, the terms being used to denote respectively an excessive number of implanted fertilized ova and birth of excessive number of living offspring has not been so easily demonstrated. Recently Cole[25] has shown this to be readily produced in the immature white rat with injections of gonadotropic hormone in pregnant mare serum, provided the recipients are within certain age limits. Rats injected with the hormone before they are 21 days old do not regularly ovulate irrespective of the dose used. However, mating and implantation of the fertilized ova will occur if ovulation results from injection at the early age limits.

When, on the other hand, the hormone is injected into adult female rats superovulation was not produced and there was only an increase in the percentage of large litters. The hyperactivity is produced in rats from 26 to 31 days of age and superovulation, superfecundity and superfertility result. As many as 28 implanted fetuses were obtained and the average number approximated the largest number found in the mature animal. Dose of the hormone is important in securing maximum effect and ovulation occurs less regularly when the dose becomes too large. The excessive burden is carried by these young growing rats without apparent sacrifice of body weight or length measurement. Indeed the contrary is evidenced. Further unpublished data being collected by the writer in coöperation with Cole indicate that repeated pregnancy with or without lactation results in actual increase in growth as compared to litter mate control rats kept in the virgin condition. This is evidence that the practice of so-called "settling" or breeding heifers going into the feed lot for finish and slaughter has more behind it than merely stopping the disturbance caused by the animals in heat riding each other.

Spaying of beef heifers is a very long established practice in some parts of the world. This was considered preferable to having them entire and settled during finishing. Much discussion has taken place regarding the procedure but in the western range country of the United States it has been gradually going out of practice. Observational data of recent years which have been more carefully made have not supported traditional evidence of its value and these are substantiated in the light of recent hormonal evidence.

Ostertag[26] at the 11th Veterinary Congress reported whole bovine male animals produced more meat on the same amount of feed than could be produced with castrates of the same breed. Also bulls at 1½ to two years of age were in as good slaughter condition as oxen at three years of age.

Evans and Simpson[19] in their studies of methods of assaying the action of hypophyseal growth hormone with the rat, used litter mate brother and sister animals in four groups, each containing six animals. The groups consisted of normal untreated, gonadectomized untreated, normal treated and gonadectomized treated animals. The

injections began at the 30th day of age and were continued for a period of eight months. Gigantism resulted in all the injected animals but varied in extent with the different groups. The heaviest animals were the injected normal males and the lightest the injected normal females while the injected gonadectomized animals were between these extremes, with the males heavier than the females.

All of this experimental data and observational evidence leads to the postulation that in the male gonads are necessary for greatest growth. In the female there is slight difference in the growth between normal and castrated. All have growth markedly stimulated by growth hormone injections. In pregnancy there is a stimulation to growth in the female. Thus growth of normal males over castrated males and growth of pregnant females over virgin complete or castrated females is due to hormone stimulation, and probably intimately associated with the anterior hypophysis. Of course there are practical reasons why males cannot be left complete where large numbers of them are remaining together, and with females also often included, under range conditions, even though more rapid growth would thereby be secured.

Within the species there are considerable variations in growth stimulus and food utilization provided the possibilities inherent in the germ plasm are given opportunity for full development. Selection can, therefore, be used when indices are developed with these factors in mind so that offspring will inherit the desirable characters which have been classified under the general term precocity. Workers in the field of animal nutrition have become involved with the problem of food capacity versus food utilization. In other words, is it better economically for meat animals to be selected on their capacity to consume large quantities of dry matter, or on their ability to utilize lesser quantities more efficiently in making rapid weight gains where both growth and fattening are taking place. Kleiber[27] has shown that conclusions drawn from the surface law of animal metabolism to the effect that large animals are more economical than small ones in food utilization is in general not correct. In energy relations the grade of an animal as a utilizer of food is determined by the ratio of the energy of its product (net energy of production) to the total food energy. Relative food capacity is the quotient of the maximum intake daily and the daily heat loss during fast (basal metabolism). Two animals are equal as utilizers of food energy if with the same coefficient of production

$$\frac{\text{net energy}}{\text{total food energy} - \text{food energy for maintenance}}$$

their relative food capacity is equal.

The efficiency of animals from baby chicks to steers as utilizers of food energy is in general independent of their body size. Therefore, the individual differences between animals of the same size and breed may be more important than the difference between species. Kleiber[28] further states that the maximum energy in an animal's daily production (net energy of production) is approximately proportional to the ¾ power of the body weight. He postulated that 266 rabbits of 3.6 pounds body weight each lose daily four times as much heat as does a steer of 970 pounds body weight. The 266 rabbits would eat daily four times as much food as the steer so that one ton of dry food would last 98 days for feeding the one steer and 24.5 days for feeding the 266 rabbits. The rabbits produce daily four times as much gain in weight as the steer and use up the feed in one-fourth the time. The gain of 206 pounds by the rabbits in 24.5 days would be the same as the gain in weight of the steer in 98 days.

Utilizing Heredity

It is very evident that heredity is involved with growth and early maturity. The problem remains as to how to harness heredity through the medium of indices so that selection can become of practical value in securing desirable types of meat animals. This can probably best be done within breeds already established, the object being to regularly produce uniform and efficient utilizers of feed in both growth

and fattening to make desirable market animals at low cost. In all classes of meat animals quite extensive variations in rate of gain and gain per hundred pounds of feed consumed are observed. This will become apparent if families within a breed are studied. Thus Guilbert and McDonald[29] at our station beef herd showed that of 11 heifers sired by one Hereford bull only one weighed over 700 pounds at 12 months of age and the other 10 varied from 600 to 655 pounds. Seven heifers sired by another male of the same breed all weighed at one year of age from 700 to 785 pounds. Several of the pure bred cows had produced calves that were included in the data from both bulls. Daily gains from birth of three steers fitted for the 1932 International Livestock Exposition at Chicago, all of which were subjected to uniform and quite ideal environmental conditions, were 2.13 pounds, 2.82 pounds, and 3.0 pounds respectively. Animals which make rapid gains in the feed lot and are finished early compared to those that do poorly and finish late are well known to all feeders of livestock. The latter reduce the profit on the former and represent to the beef cattle industry what are spoken of as "boarder cows" to the dairy industry. Most meat animals, whether cattle, sheep, or hogs, are slaughtered at present before growth is completed and the problem is, therefore, one of growth as well as finish.

In his studies on the nature of size factors in domestic breeds of cattle Gregory[30] developed the round measurement. He then took one skeletal measurement, height at withers, as Eckles and Swett[31] had shown this to be a satisfactory method of expressing skeletal development. Thus the general conformation of an animal may be expressed in statistical units. The formula is quite constant from birth to maturity in beef breeds but not so constant for dairy breeds.

When through selection standards greater uniformity and efficiency are secured in our meat animals there still remains the resource of cross breeding and so-called criss-cross breeding for the full development of heterosis in practical livestock husbandry to utilize knowledge obtained by fundamental studies on the intricate problem of growth and early maturity.

References

1. Spemann, H., 1918. *Arch. Entw. Mech. Org.* 43:448.
2. Spemann, H., 1921. *Arch. Entw. Mech. Org.* 48:533.
3. Spemann, H., and H. Mangold, 1924. *Arch. Entw. Mech. Org.* 100:599.
4. Waddington, C. H., 1932. Phil. Trans. B. 221:179.
5. Needham, J., C. H. Waddington and D. M. Needham, 1933. Proc. Roy. Soc. London, Ser. B. 114:393.
6. Waddington, C. H., J. Needham, W. W. Nowinsky and R. Lemberg, 1935. Proc. Roy. Soc. London Ser. B. 117:289.
7. Hale, J. F., 1933. *Heredity* 24:105.
8. Hart, G. H. and H. R. Guilbert, 1933. Calif. Agr. Exp. Sta. Bul. 560.
9. Mason, K. E., 1935. *Amer. Jour. Physiol.* 57:304.
10. Donaldson, H. H., 1932. *Amer. Jour. Anat.* 50:359.
11. Painter, T. S., 1928. *J. Exp. Zoöl.* 50:441.
12. Castle, W. E. and P. W. Gregory, 1929. *J. Morph. and Physiol.* 48:81.
13. Castle, W. E., 1929. *Jour. Exp. Zoöl.* 53:421.
14. Hammet, F. S., 1930. Proc. Am. Phil. Soc. 69:217.
15. Gregory, P. W. and H. Goss, 1933. *Amer. Naturalist* 67:180.
16, 17, 18. Gregory, P. W. and H. Goss, 1933. *J. Exp. Zool.* 66:155 and 335; 1935, 71:312.
19. Evans, H. M. and M. E. Simpson, 1931. *Am. J. Physiol.* 98:511.
20. Goss, H. and P. W. Gregory, 1935. Proc. Sec. Exp. Biol. and Med. 32:681.
21. Lee, M. O. and N. K. Schaffer, 1934. *Jour. Nutrition* 7:337.
22. Patrusev, V. I., 1937. Comptes Rendus (Doklady) de l'Acad. des Sci. de l'U. R. S. S. 14:573.
23. Blunn, C. T. and P. W. Gregory, 1935. *J. Exp. Zool.* 70:397.
24. Gregory, P. W., V. S. Asmundson and H. Goss, 1936. *J. Exp. Zool.* 73:263.
25. Cole, H. H., 1937. *Amer. Jour. Physiol.* 119:704.
26. Ostertag, R. v., 1930. 11th International Vet. Cong. London 2:257.
27. Kleiber, M., 1933. *Die Tierernährung* 5:1.
28. Kleiber, M., 1936. Proc. Amer. Soc. An. Prod. p. 247.
29. Guilbert, H. R. and A. McDonald, 1933. Proc. Amer. Soc. An. Prod. p. 244.
30. Gregory, P. W., 1933. *Genetics* 18:221.
31. Eckles, C. H. and W. W. Swett, 1918. Missouri Agr. Exp. Sta. Bul. 31.

Purulent Osteomyelitis of Mandible in a Horse*

EXAMINATION of a ten-year-old horse reveals a spindle-shaped, solid, painless enlargement confined to the lower margin of the left mandible in the region of the first premolar. The tumefaction is not movable upon its basis. The skin reveals no injury. When chewing the horse exhibits pain, and, therefore, eats very little food. Palpation of the molars at the site of the distention discloses a minute cavity in the grinding surface of the first premolar. It is filled with ill-smelling food particles. The remaining teeth are normal. The esophageal lymph nodes are slightly, but not painfully, enlarged.

Question.—What anatomical and histological structures are encountered in surgery in this region?

In the area of distention, a vertical incision downward cuts through the hair-covered and pigmented epidermis, the loose connective tissue of the subcutis, the periosteum, the external tela ossea, the bone marrow, the inner tela ossea, and the inner periosteum of the lower maxilla. In the medullary cavity, cutting upward, one meets the osseous basis of the alveolus of the first premolar. This alveolus is inserted funnel-shaped in the medullary cavity of the lower jaw. The latter cavity runs parallel to the lower margin of the maxilla; it contains the mandibular canal, which houses the nervus alveolaris mandibulæ and the arteria alveolaris mandibulæ.

From a surgical point of view the anatomy and histology of the area is complicated insofar as it involves tissues possessing important vital functions; moreover, the relationship of the tissues to each other must of necessity give rise to retention of secretion; and finally, there exists the possibility that the infection may spread along the preformed route of the mandibular canal.

Question.—Which of these tissues are reactive to stimuli? Which one of these stimuli may have attacked directly and may still be capable of attacking indirectly?

On account of its anatomical situation the swelling is easily accessible to clinical examination (inspection, palpation). Therefore, from the clinical finding of a painless, firm distention and the intact, nonmovable skin, one draws the conclusion that the enlargement affects the bone, and that it is of a chronic nature. However, preliminary calculation teaches that the bone does not need to be affected in all its parts, and that sundry stimuli may be responsible for the individual lesions of different parts of the bone. The simultaneous painful affection of the first premolar in the periphery of the osseous distention offers a suggestion in this direction. In the absence of this simultaneous toothache one might reason that these divers stimuli in the region of the lesion act either from the outside or from the inside. By this means the responsible stimuli may be discovered by comparison with the clinical findings. In either case one would arrive at the correct conclusion. However, a decision cannot be reached yet, because the various reactions of the bone to each stimulus have to be considered first. Then, by comparison with the tissue reaction recognizable in the clinical picture, a choice may be made.

Question.—How do these accessible tissues react to the stimuli in question?

The ease with which the clinical examination yields information facilitates the recognition of the tissue exposed to the probably causative stimulus. The criticism may now be restricted to the reaction of the bone. It stands to reason that this simplifies the solution of the problem concerning diagnosis and etiology. As possibly responsible stimuli we mentioned, above, mechanical and specific ones, and there is reason to believe that the causative agent was a stimulus attacking the lower jaw externally. The fact that the skin is intact does not exclude this possibility. The tooth lesion of the first premolar occurring simul-

*Excerpted from a chapter of "Die Chirurgie des Tierärztes", by Prof. Dr. Paul Henkels, Veterinary College, Hannover, Germany. Translated by F. Volkmar.

taneously and probably connected with the disease of the bone might be of a secondary origin. When we consider this theory on the basis of our clinical examination, we come to the following assumption: Suppose that in our preliminary reasoning, repeatedly mentioned, trivial but frequent mechanical stimuli had caused a proliferation of the fibrous layer of the periosteum, then, the distention would not possess the hardness of bone, but the denseness of tendon (callosity of periosteum). If the stimulus would have excited a proliferation of the cambium layer of the periosteum, then this reaction (exostosis) could be brought in sole connection with the swelling; but that would not give a satisfactory explanation for the tooth anomaly. If we presume a single powerful mechanical stimulus, such as a fall or a kick, which would have caused a fracture without severance of the skin, then we have to consider the bone tumefaction as a callus. But this again does not explain the tooth affection. Of course, one might imagine that a fracture of the jaw might simultaneously split a tooth or cause a lesion of an alveolus which indirectly might involve a painful toothache. It would allow food particles to enter between the tooth and the periosteum, or between the parts of the split tooth into the pulp cavity; accordingly, a purulent alveolar periostitis or pulpitis might result. The pus might penetrate into the medullary cavity of the maxillary bone and might cause, first, a purulent osteomyelitis, then a periostitis, and finally a deposit of bone. But in that case the fracture would be a large one and surely would have caused bone proliferation to a much greater extent than is shown in the limited enlargement of the left mandible.

If we pursue the second train of thought in which we assumed that specific stimuli, which have their origin in a primarily diseased tooth, were the exciting cause of the process, then the theoretical course, in accordance with the present clinical findings, would be as follows: The food particles, entering the masticating surface in the wake of a carious tooth or a fractured tooth, open up a channel to the pulp and infect the latter, causing a purulent pulpitis. Through the foramen apicale, situated on the apex of the root of the tooth, the pus reaches the periosteum of the base of the alveolus; this causes first a purulent alveolar periostitis; then a separation of the periosteum, and contact with the thin, osseous wall of the alveolus; later a necrosis, penetrating into the medullary cavity of the lower maxilla; and finally a purulent osteomyelitis. The character and extent of the osteomyelitis depend upon the virulency and the number of attacking germs. Since the bacteria contained in the saliva of the horse are usually of low virulency, this practically precludes a progressive purulent osteomyelitis. In consequence, cases of a purulent penetration into the mandibular canal and the corresponding affection of additional roots of teeth are rare. Almost always the osteomyelitis produced is localized. As a rule, the pus follows more the law of gravity than the destructive power of its ferment. It has a tendency to travel to the lowest level, in this case the lower margin of the maxilla. Due to its low virulency the pus probably could not set up enough irritating activity to produce a periostitis of the external side of the bone, or even to penetrate the outer osseous lamella of the lower maxilla by means of necrosis, if it were not for the factor of time. In the example under discussion, the shape and extent of the osseous distention corresponds etiologically quite clearly to the construction of this assumed theoretical course. Thus far the pus has not succeeded in breaking through the external wall of the bone and through the skin. However, this would be apt to occur in time, although not necessarily. The result of the clinical examination of the mouth cavity and of other clinical manifestations corresponds closely with the theoretically construed possibilities that we have to consider the etiology and diagnosis in this case as confirmed.

Mention must be made that the outcome of the differentiation between these two etiological possibilities, applied purposely to this condition, would have no bearing upon the prognosis or therapy. No matter

whether the exciting agent acted from the outside or from within, therapy and prognosis remain the same.

Question.—What are the possibilities for regeneration of the diseased or endangered tissues?

To answer this question we have to consider first the spontaneous course of the disease in the absence of any treatment. For the ability of the diseased tissue in the case under consideration to regenerate is self-evident. Ability of regeneration of a tissue, in general, means the power of resistance of this tissue toward the entrance of attacking stimuli, the ability of eliminating these stimuli, or of rendering them harmless, and the ability to repair any tissue defects caused by these stimuli.

In the case under discussion the periosteum of the alveolus and even the osseous wall of the alveolus and the medulla, naturally, put up a defense toward the penetration in the manner described in the preliminary reasoning; that is, all the tissues mentioned attempt to render the germs and toxins harmless by means of cellular and humoral defensive mechanism, and to prevent their progress by a proliferation of cells starting from the periphery. But, as mentioned before, the continuous supply of germs and the long-continued contact with pus, finally bring about the infection of the marrow. But, on the other hand, the powerful defensive mechanism of the marrow succeeds in localizing the infection. Just as described in the preliminary deduction, the pus has contacted the outer osseous lamella on a small surface only; through radiation of the stimuli it produced the external periostitis ossificans, resulting finally in the distention shown in the clinical picture. If one would leave the disease process to its fate, without surgical interference, then the possible results might be predicted easily. One possible outcome might be that the germs still present in the marrow cavity would possess a virulency (quantitatively and qualitatively) so low that proliferation of the marrow tissue would preponderate, consolidating the entire area (condensing ostitis), and restricting the purulent process to the alveolus and its immediate neighborhood. Another possible outcome might be that the stimulus of the pus is so powerful as to prevent the consolidating effect of the proliferation. Then, the pus capable of melting the bone masses, added to the outside from the center, would penetrate into the subcutis and finally perforate the skin. The result would be a so-called dental fistula, that is the pus by its continuous supply of germs, pus cells, and masses of exudate would slowly form a so-called fistulous canal, reaching from the alveolus to the skin opening. It would remain open as long as pus matter, germs, and toxins are discharged from the alveolus. This supply, naturally, would not cease until the granulation tissue in its demarcating progress toward the tooth, which acts as a bacterial focus and foreign body, succeeded in protecting the marrow against the alveolus and its contents, and thus rendering the entire canal sterile. The lumen of the canal would then be filled quickly with granulation tissue—osteoid tissue. The membranous fistulous canal, too, will heal in this manner. But it is not practical to wait for the demarcation mentioned because of the irritating effect of the pus. New germs enter the diseased pulp and the alveolus continuously from the mouth through the food; they cause disintegration and pus formation; they collect at the base of the alveolus and thus prevent the demarcation just mentioned. Especially the latter type of the developmental possibilities described above may cause in the animal such long-continuing and extreme pain that it will actually starve to death. In the course mentioned first, the alveolar walls may be rendered necrotic and the tooth brought entirely out of connection with the wall, and become demarcated. The tooth and sequestered particle of bone are, due to the alveolar periostitis, completely coalesced with each other and form together, so to speak, a sequestrum which uses the demarcation cavity as a coffin. When this process takes place in the upper maxilla, then this sequestrum-like complex may, by its own weight, fall out, and thus eliminate itself spontaneously.

Care of the Broodmare*

By LLOYD C. EWEN, Lt. Col. V.C., and FLOYD C. SAGER, Lt. Col. V.C., Front Royal, Virginia

The army veterinary service is charged with the care, breeding, feeding, and general supervision of army broodmares. The broodmares are kept in a separate pasture and stable. They do not leave this area except for breeding and such care as cannot be given them in their own stable.

Selection of Broodmares

A mare selected for breeding should have well established feminine characteristics, together with a good disposition; her way of going should be straight, heart and loin girth well developed, the loin short and well coupled, and ribs well sprung and of good length. The mare should have good conformation, be free from congenital defects, and should be relatively large and well developed; legs straight and free from unsoundness. A good quality of bone is paramount; joints should be neat and free from roughness, yet show adequate bearing surface. Short cannons and low knees and hocks are desired. While age is not a determining factor young mares are preferred.

Exercise of Broodmares

Barren Mares.—To prepare barren mares for breeding they are fed a good nutritious diet; one rich in protein, mineral matter, and green feed. Associated with regular feeding the mare should have enough slow and regular exercise to induce the best assimilation of food ingested. This will be denoted by a firm consistency of flesh, brightness of eyes, alertness, and bloom of coat. There must be a judicious balance between feed and exercise, coupled with good stable management to bring this about. Exercise can be accomplished in various ways. We have not failed to get a mare in foal when given regular work in a team at the veterinary hospital. These mares may also be exercised in large pastures while grazing if they are not indolent.

Foaling Mares.—Foaling mares must receive daily exercise with adequate feed as described for barren mares. At this depot we depend upon mountain climbing while mares are in pasture to provide this exercise. In some instances it may be necessary to lead the animals when foaling time draws near. At one of the nearby nurseries a large sweep, under enclosure, is used in inclement weather to exercise the mares. An increase in the allowance of hay may be necessary for animals near foaling.

Feeding

In feeding broodmares it is of paramount importance that the attendant in charge follow instructions as given. This man should have a thorough knowledge of stable management; good, sound judgment, and experience in this line of work. A good supply of hay (timothy, timothy and clover mixed, grain hay or upland prairie) is essential. This is best when fed in conjunction with alfalfa or other leguminous plants to increase the protein and mineral content of the ration. Concentrates fed in the ration consist of oats, corn, and wheat bran. Rolled oats are preferable. The feeding of cracked corn during cold weather, not to exceed one pound per day, is desirable. The ratio of protein to carbohydrates and fats should be about one to seven. The amount of hay and grain fed at different seasons varies considerably. When pasture is good, very little or sometimes no grain is fed, but later in the season as high as 16 pounds of grain per day may be fed to the mare and the foal she is nursing. Bran is fed dry with the grain ration and should not exceed 10% of the grain allowance at any time.

The hay allowance varies in about the same way as the amount of concentrates fed—from nothing in the early spring to all the mare will consume later in the season. The hay allowance may run as high as 30 pounds per day for some individuals;

*Extracted from a discussion of Animal Management at a Remount Depot by Cols. Ewen and Sager in the *Veterinary Bulletin*, 33:1, a supplement to the *Army Medical Bulletin*.

the average is about 20 pounds. About five pounds of alfalfa per day, fed in conjunction with other hay, is sufficient. Salt and potable water should be available at all times. The increase in grain and hay allowance is to provide a goodly supply of milk for the foal and at the same time keep the dam in good condition.

It is assumed that the mares have access to good pasture, especially during the spring, summer and early fall. Winter pasturing is to be encouraged when weather conditions permit.

Broodmares should be provided at all times with a comfortable bed of straw. Barren mares may be bedded with shavings if this is the more economical.

Physical Examination Prior to Breeding

In discussing this examination we are describing the mare in ideal breeding health. There will be deviations from this standard in most broodmares. Slight changes are not prohibitive to breeding.

The mare should be in good health, indicated by good appetite, bright eye, and bloom of coat. When the mare is satisfactory in these respects an examination of her genital tract is made.

In preparing the mare for this physical examination, the external genital organs are thoroughly washed with soap and water, fresh pieces of cotton being used each time. Remove all soap lather with warm water. The area is then washed in a mild antiseptic solution. We use a 5% solution of therapogen for this purpose. The lips of the vulva are parted and the inner surfaces included in the washing process. After washing, the external genitals are thoroughly dried with dry cotton.

Equipment for the examination consists of two buckets and a vaginal speculum, one bucket containing clean water and the other antiseptic solution. After each examination the vaginal speculum is washed and placed in antiseptic solution. Before using again the speculum is dried thoroughly with a clean towel.

The examination of the genital tract must be made when the mare is not in heat. If examination shows her to be in heat, this procedure must be repeated at weekly intervals until the heat period has passed.

The vulva should have plenty of muscular tone and the lips of the vulva should close tightly, preventing the admittance of infection, with aspirated air, into the genital tract. The vagina is examined by inserting a sterile speculum. This examination must be made quickly before the appearance of the mucous coat is affected by the entrance of cold air. In a normal mare the mucous lining of the vagina is coated with a clear, gummy exudate. This exudate is found adherent to parts of the speculum when it is withdrawn. The mucosa is normally highly elastic and of a dull white or pale color. Slight variations from the normal appearance are frequently seen. The cervix should be closed. It should be firm to the touch and should protrude into the vagina well above its floor. The color

The very high breeding efficiency of mares maintained at Army Remount Depots is well-known in veterinary circles. It was forcefully impressed upon those who visited the remount breeding station at Fort Reno during the A. V. M. A. meeting at Oklahoma City in 1935. While the army methods are not entirely practical for others, they are applicable in the main on large breeding farms and to a considerable degree adaptable to horse breeding on the average farm engaged in the production of grain, forage, and live stock. Aside from the intense practical value of this discussion to all veterinarians called upon for any service whatsoever in horse breeding, it rates high in interest and importance as a description of how one branch of the veterinary profession has achieved conspicuously.

should be similar to that of the vagina; that is, it should be free from congestion and inflammatory processes.

A rectal examination is made of the ovaries and uterus after completing the vaginal examination. Ovaries should be relatively large and firm to the touch. Cystic ovaries are very common; however, they are less apt to prevent conception than are small indurated ones. A fibrous condition affecting ovaries is looked upon with disfavor. A normal non-gravid uterus is found lying in the pelvic cavity, the horns extending slightly into the abdominal cavity.

Both the body and horns of the uterus should be firm, of good tone, and elastic to the touch, as felt through the rectal wall. The size of the uterus varies with the age of the mare and the number of foals which she has borne. A soft, flabby uterus is not considered favorable to conception.

Should the physical examination prior to breeding reveal marked deviations from the normal, treatment for the conditions should be accomplished before breeding.

The collection and examination of laboratory specimens are an aid in making a correct diagnosis and in treatment. Routine blood tests for dourine and equine infectious abortion are made on all mares prior to their addition to the broodmare band.

Determination of Heat Period

Accurate determination of the estrual cycle is, in our opinion, the most important single requirement in the breeding scheme. The heat period is determined by the use of a stallion, commonly called the "teaser." This test should be verified by a vaginal examination with the speculum. Maiden and barren mares show wide variations in their heat periods. It is not at all uncommon for a mare to go 90 days with no manifestations of sexual desire. It is still more common for a mare to show desire to the "teaser" daily for periods of 75 days. With this type, the vaginal examination must be relied upon. We find the best course to follow is to start teasing at least 30 days prior to the date established as the opening of the breeding season and to breed no mare until she has gone out of season at least once. This is done to establish the estrual cycle of each. Accurate teasing records are one of the most valuable assets of the breeding scheme. The teasing of mares should take place as far as possible under normal conditions. We do all of our teasing with the mare in her own stall. The top door of the stall is opened and the stallion led to her door where he is allowed to interview the mare. The stallion attendant must be an experienced man and the longer he has known each broodmare, the greater his knowledge of her idiosyncrasies. This is quite an advantage. The experienced breeder can determine largely by the expression of the mare's eye during the teasing period, whether or not she is in heat. When in season the eye appears mild, as contrasted to a look of rage when not in season. The mare which is in heat will usually come to the door of her stall to greet the stallion when he arrives. After allowing the stallion to nose her about the neck and shoulders she will turn her tail to the door, allowing the horse to nose her flanks, croup, and tail. When she reaches this stage she will almost invariably raise her tail and the lips of the vulva will open and close repeatedly, disclosing the erected clitoris. The vulva is relaxed and somewhat swollen, smoothing out all the wrinkles which are present when not in season, and the vulvar opening appears to be much longer. There is also a small amount of mucus present between the lips of the vulva. There are frequent emissions of urine in small quantities. It is always well to watch a mare for a few moments after the "teaser" leaves her if she has not shown conclusive evidence of estrum as she will frequently "squat" and urinate a few moments after being teased. A mare in heat will always raise the tail if the finger is inserted into the opening of the vulva and the internal lips gently massaged.

About 2% of mares in heat fail to demonstrate sexual desire in the presence of the stallion; as a rule they show neither positive nor negative signs of estrum. Examination with the aid of the speculum must be relied upon to determine their estrual periods. At our depot, mares that apparently

fail to come in heat for 30 days or more are examined with the aid of a speculum at least twice weekly until the estrual period is determined.

On the other hand, about 25% of our mares have reacted to the "teaser" as if in heat continuously for 40 days or longer; vaginal examination, however, disclosed no true sign of estrum. For this reason, every mare, although showing definite signs of estrum on teasing, is given a check vaginal examination the day before she is bred.

In other words, in using the "teaser" to determine the estrual period, due allowance must be made both for shy mares that appear to be afraid of the stallion, yet show vaginal signs of being in heat; and for mares manifesting signs of heat to the "teaser" yet showing no vaginal evidence of estrum.

The following evidence of estrum as opposed to diestrum are disclosed by the speculum examination:

Estrum	*Diestrum*
The mucous lining of the vulva and vagina are pink in color due to the increased blood supply to the parts.	The lining membranes are pale in color.
The mucus covering the lining is increased in amount and is soft, thin, and lubricous.	The mucous covering is thick, sticky, and gummy.
The cervix is relaxed, open and somewhat edematous and usually approaches the floor of the vagina.	The cervix is closed, is pale in color and extends into the vagina well above the floor.
The speculum can be easily inserted and withdrawn due to the lubrication of the parts.	The speculum is inserted and withdrawn with some difficulty due to the stickiness of the mucus.

The estrual cycle varies from 12 to 28 days, the average being about 21 days.

Mares with foals at the side present still other problems. They may not respond to the teaser, because of maternal instincts for protection of their foals. They should be moved out of hearing distance of their foals and tried again. Some mares will favor one "teaser" but not another. We always try such mares with at least two stallions. Mares that have foaled show their first heat period from five to 17 days after parturition, the average being eight days. All mares in the band are teased every second day throughout the entire breeding season. Foaling mares are added to the teasing list the fifth day after parturition.

Breeding

Barren and Maiden Mares.—Having examined the mares as outlined in the foregoing and having satisfied ourselves that the mare is in season she is moved to the breeding shed. To repeat, the vaginal speculum examination has been made the day before breeding. The reason for this early speculum examination is to avoid the entrance of air into the vagina and uterus of the mare on the day of breeding. Occasionally there are stallions that will refuse to serve mares that have just been examined with a speculum. The mare is now placed in the teasing stall and the second "teaser" allowed to interview her to establish the fact that the mare is still in season, also to allow her an opportunity to empty her bladder before the actual service. No harm will result from the use of the stallion to be mated with her as the second "teaser". She is now led into the breeding room, twitched, hobbled, and her tail wrapped with a clean bandage. The external genitals are now thoroughly washed with a non-irritating soap and clean water. This is accomplished by saturating a piece of cotton in warm water and rubbing it on the cake of soap until sufficient lather is formed. The attendant then scrubs the vulva, anus and surrounding perineal region, including the buttocks, until clean. The soap is then washed off with a clean wet piece of cotton

and this operation repeated until the entire area is clean. The area is now dried with cotton. The lips of the vulva are parted with the fingers and warm water is dashed into the orifice with a pledget of cotton saturated with water. The inside of the lips of the vulva are then dried with cotton. Fresh cotton should be used for each application. Used cotton is discarded into a suitable receptacle. The mare is now ready to be covered.

The stallion having been prepared for service is allowed to approach the mare and as he mounts the attendant assists him by pulling the mare's tail to one side and guiding the penis into the vulva. Close observation must be given the stallion to be sure that he ejaculates. This is usually denoted by the so-called "flagging of the tail". As the stallion dismounts, the veterinarian in attendance seizes the penis and collects the semen that drips from the urethal opening. It is collected in a heavy glass graduate which to this moment has contained warm water. The semen is immediately strained through two layers of sterile gauze into a sterile warm container (crockery preferred) and a half-ounce gelatin capsule is filled with semen from this container. This capsule is immediately inserted into the uterus of the mare. The veterinarian wears a long-sleeved obstetrical glove for this operation. Mares are "capsuled" as a double assurance that semen is actually deposited in the uterus. "Capsuling" is routine, except for mares in their first heat period following parturition. A mare whose vulva has been sutured must have a tape suture applied loosely to support scar tissue and prevent tearing at time of service. This suture is run through the lips of the vulva at the ventral end of the scar and is just tight enough to prevent the scar tissue from tearing. Immediately after breeding the suture is removed. No further care is necessary. As soon as possible after breeding, the mare is walked to her own stall. The attendant is instructed to keep her moving, and not faster than a walk. This is done to prevent her from straining. From this point on she is teased at regular intervals; but not re-bred until a new estrual period appears.

Foaling Mares.—The same routine is followed, except that:

Mares are not bred until the ninth day after parturition. The readjustment of the genital organs from that of a pregnant mare to a state of normal estrum requires eight days.

Foaling mares are not "capsuled", due to the fact that the cervix is open and the genital organs are more susceptible to infection.

Should estrum reappear after breeding, the mare is rebred as described above. Rarely do we double breed in the same heat period, except mares difficult to get in foal and those near the close of the breeding season.

Occasionally a service, especially in maiden mares, will result in a mild vaginitis. This is not treated during the current heat period. However, if it is present in the next estrual period, the mare is not bred, but treated.

Test for Pregnancy

Tests for pregnancy on all mares that have passed their first heat period are made between the 39th and 49th day after the last service. The mares are examined manually per rectum and the findings are recorded. This manual examination is begun by raking the lower bowel to free the rectum of fecal material. The veterinarian wears a rubber glove and obstetrical sleeve, which is adequately lathered with a mild soap. Through the rectal wall the operator palpates the uterus, including the horns, for signs of pregnancy. He proceeds cautiously with the examination, applying no more pressure to the uterus than is necessary. It is difficult to give a word picture of the many conditions, that mean much to the experienced veterinarian. However, a pregnant uterus is one manifesting good muscular tone. The uterus may be slightly forward, except in maiden mares. Between the 39th and 49th day of pregnancy one finds in one of the horns or the body of the uterus, a small enlargement, varying in size from that of a turkey egg

to that of a baseball. Should the enlargement be in the body of the uterus, it will usually be found on its ventral surface. Occasionally the enlargement in the horn will be associated with a doubling (kinking) of the horn upon itself. This pregnancy test is more difficult to make on foaling mares, due to the size and condition of the uterus, than it is in the case of maiden or barren mares.

Associated with this manual examination we run a rat test for pregnancy between

Good Type Army Remount Stallion

the 42nd and the 120th day of pregnancy. Technique for the rat test is as follows: 2cc of whole blood is taken from the jugular vein of the mare and injected intraperitoneally into a virgin female rat, between 20 and 30 days of age. The rat is identified by marking with colored dye. Seventy-two hours later the rat is asphyxiated with carbon tetrachloride and a post-mortem examination made. If the mare is pregnant, the uterus of the rat will be enlarged from three to four times its normal size and filled with fluid. All surrounding fat will have disappeared. The ovaries will be from four to five times larger than normal, greatly congested and show numerous corpora hemorrhagica follicles. If the mare is not pregnant, the uterus and ovaries remain normal. There is one exception to this; a mare that has been pregnant and aborted after the 50th day continues to react positively to the rat test for a longer period than that shown by a pregnant mare; therefore, the double check for pregnancy at this time.

On the 90th day of pregnancy and prior to vaccination for equine infectious abortion, all mares are again examined manually for pregnancy.

About November 1st, each year, just prior to separating barren mares from mares in foal for winter quartering, all mares are given a final manual examination for pregnancy.

Immunization of Mares

Pregnancy having been diagnosed, all mares are immunized against equine infectious abortion during the fourth and ninth months of gestation. The bacterin is administered subcutaneously in three doses of 2, 3, and 5cc respectively, with seven-day intervals between injections.

The same routine is carried out for the second immunization during the ninth month of pregnancy. The injections begin immediately upon completion of eight months of gestation.

The site for the subcutaneous injection is the superior third of the side of the neck and the area is cleansed with denatured alcohol prior to injecting the bacterin.

Foaling

In the fall, insofar as possible, pregnant mares are placed in the stall in which they are to foal. As foaling time draws near the stall is bedded sufficiently but not too abundantly. A night watchman is kept on duty with these mares throughout the entire foaling season. An experienced, specially trained attendant is with every mare at the time of parturition. This man must be carefully selected with a view to his knowledge, experience, reliability, and temperament. All mares are observed closely for evidence of approaching parturition as the end of gestation draws near. This is evidenced by the making of bag, relaxation of the muscles and ligaments of the croup and external genitals. Most mares show wax at the teat opening about 12 to 24 hours before parturition and actually run milk for 3 to 4 hours before parturition takes place. There is a wide variation in this, however, as some mares foal without the formation of wax and still others run milk for days before they foal. If records have

been kept on past performances of foaling mares it will be found that individuals run quite true to form in this respect. As labor pains first appear the mare shows great uneasiness and, usually, a decided friendliness toward the attendant. She walks her stall, stamps her feet, and switches her tail. She shows an increased body warmth, very noticeable to the hand, and may sweat a little. The allantoic sac may burst before, after, or at the time of lying down. If the allantoic sac is not open the attendant ruptures it with his fingers. At this time the mare must be watched constantly. A mare that is up and down frequently, apparently being unable to select a suitable spot in her stall for delivery, is almost invariably in trouble and should be given a manual examination by the attendant. Improper presentation and deviations of head and legs are usually more or less easily corrected at this time while the mare is still on her feet and before she starts to strain violently. The average mare will foal within 15 minutes after labor pains become acute. Assuming that parturition is progressing normally it is most important that the attendant use excellent judgment at this time. The majority of mares need some assistance, and the attendant must know when to exert traction on the protruding legs and when not to; how much traction can be safely exerted, and in which direction. Many foals are lost because of the lack of proper assistance when it is needed. A second man is kept on duty at the foaling barn throughout the foaling season to assist the specially trained attendant. In the event he feels the situation is going to be too difficult for him he immediately calls the veterinary officer, but always continues to the best of his ability to secure the foal while awaiting the latter's arrival. As the foal comes away from the mare care must be exercised in removing the hind legs to prevent injury to the genital tract of the mare.

The foal having been delivered, we see that nostrils are free from obstruction of any kind. If the foal fails to gasp for breath, artificial respiration is applied and the mouth opened. If the umbilical cord does not separate naturally, this should be accomplished by traction. There is always a little constriction of the cord about two inches from the belly of the foal. The cord is grasped between the thumb and forefinger of the left hand and a loop of the cord placed around the index finger of the other hand and pulled apart. The umbilical stump is thoroughly saturated with tincture of iodine. This is best done by saturating a piece of cotton with tincture of iodine and holding it firmly over the stump and adjacent area for about a minute. Under no circumstances should this be neglected, nor should the stump be ligated as ligation prevents drainage of the protruding vessels. One application of tincture of iodine if properly applied is sufficient. Repeated treatment with tincture of iodine tends to inhibit the normal desiccation of the stump and has a tendency to bring about the condition known as persistent urachus. We move the foal to near the head of the mare, placing it on dry straw, where there is less danger of the mare injuring it as she attempts to rise. We then clean the stall thoroughly and provide her with a bed of new, clean straw. The straw is banked along the wall and corners, leaving about a four-inch layer in the middle of the stall. Buckets and protruding objects are removed. We do not dry the foal unless the mother refuses to do so. We watch this and note the time of expulsion of the fetal membranes. After expulsion they are immediately removed from the stall and placed in a marked container for examination by the veterinary officer. The attendant now enters on the foaling record the time of foaling and the time of expulsion of the fetal membranes. As soon as both mare and foal are on their feet, the attendant gives aid to the foal in nursing if necessary and he may have to assist the colt to rise. No foal is allowed to go more than eight hours without emptying its lower bowel. If the meconium is not expelled an enema of warm soap-suds prepared from a mild non-irritating soap is given. This is repeated as necessary until the normal yellow feces appear. It may be necessary to remove hard, large, dry balls

of meconium manually. This procedure will eliminate colicky pains the colt might otherwise manifest.

After-care of the Mare and Foal

The mare is not allowed to retain fetal membranes for more than eight hours. If retained this long they must be removed manually. We do not believe in douching with antiseptics at this time, for to do so removes the natural protective exudates which seem to have great bactericidal action.

Weather conditions permitting, the mare and foal are placed in a small enclosure for a short sun bath the first day. These periods are lengthened daily for about a week. The foal and mare are then allowed to run with the foaling band. The mother is usually given a warm bran mash following parturition. The chill is removed from her drinking water.

The fetal membranes are weighed and examined to ascertain that they are complete and free from abnormalities. The external genitals are examined for tears and, if necessary, repair is effected.

On the sixth day the mare is examined with a vaginal speculum to determine whether or not her reproductive organs have returned to normal following parturition. If normal, she is not examined again before being bred in her first heat period. If she shows tears, lacerations, or discharges, she is reëxamined on the eighth day following parturition. At this time definite decision is made as to whether she will be bred or passed over in ninth day breeding. Mares foaling dead, diseased, or sick foals, or that retain the fetal membranes for more than three hours, or that show evidence of vaginal infection on the sixth day, are not bred back during the first heat period.

Surgery

Pregnant, barren, and maiden mares which have poor muscular tone to the vulva or aspirate air into the vagina are operated upon as follows External genitals are thoroughly cleansed as described elsewhere in this article. The lips of the vulva are injected with a 1½% solution of procaine to anesthetize the part. The lips of the vulva are scarified, using a scalpel and blunt pointed scissors, removing the mucous coat not to exceed one-half inch from the junction of skin and mucosa. The scarified surfaces are then placed in direct apposition and sutured with metal clips. Clips are placed very close to one another. The area is then covered with a 1% yellow oxide of mercury ointment. Clips are removed on the sixth day after suturing. The vulva should be closed ventrally about one-half inch below the ischial arch. The reason for this operation is to prevent the aspiration of air into the vagina and also to exclude the débris and infection that would otherwise enter. The necessity for this operation is most frequent in pregnant mares; next barren mares, and lastly maiden mares. Animals needing this operation vary from the exaggerated case in which the lips of the vulva are actually inverted to the mild case in which the aspiration of air can be heard only as the animal moves. Still other mares practice this abuse only during their estrual period. The exclusion of air from the vagina of a breeding mare will increase her breeding efficiency immeasurably. Mares that have an infection of the vagina due to the admission of air carrying infection usually recover, in about two months after suturing, without further treatment.

Foaling mares that have had the lips of the vulva sutured must be opened just prior to parturition. The nearer the actual hour of parturition this is accomplished, the better it will be. When the vulva is relaxed for the expulsion of the fetus it may be opened without anesthesia. We perform this operation with a blunt-pointed bistoury by grasping the lower commissure of the vulva and pulling it taut, inserting the bistoury beneath the scar tissue and incising the vulva dorsally until the natural opening is restored. If this incision is made too soon the raw surfaces will invariably heal together; if it is not made before parturition occurs, irregular tears of the lips of the vulva will result. The morning following parturition every mare is examined, and any external tears are repaired by suturing. Occasionally in breeding a sutured mare it is necessary to incise the scar if the re-

maining orifice in the vulva is too small to allow copulation. If this is done, the incision is resutured immediately after breeding.

Worming

All mares in the broodmare band are wormed for ascarids, strongyles, and bot larvæ as follows:

Pregnant, barren, and maiden mares which are not nursing foals are wormed in August or September for the removal of ascarids and strongyles. Carbon tetrachloride and sodium sulphate are used for this medication in the following dosage: 50cc of carbon tetrachloride and from 600 to 800cc of sodium sulphate solution containing 30 grams of sodium sulphate to 100cc of water. This is administered by gravity through a stomach tube, the tetrachloride being given first and followed immediately by the salts solution. The animal is prepared by fasting for a period of 24 hours before medication. She is allowed water *ad lib*, but no feed until after treatment. Some authorities recommend the animal be not fed for a period of five hours after treatment. However, we have had excellent results releasing the animals to pasture two hours after completion of treatment, returning them to full hay allowance and half grain allowance that night. The following day normal feeding is resumed.

Mares nursing foals are wormed with the foal 10 days to two weeks prior to weaning. The procedure for the mare is the same as described in the foregoing. The foal (five months of age or older) is fasted with its mother except for milk she gives it. The foal is medicated at the same time the mare is treated. We treat the foal first, giving it 12cc of carbon tetrachloride and 200 to 400cc of sodium sulphate solution. Aftercare is the same as for the mare. For mares with suckling foal (late foaling mares) the time of worming may be as late as October or November.

All pregnant, barren, and maiden mares are treated for removal of bot larvæ about three weeks after the first killing frost. This is accomplished as follows:

Broodmares are fasted for 18 to 24 hours, all hay, grain, and bedding being removed. We give 24cc of carbon disulphide via stomach tube by gravity, followed immediately by 150cc of lukewarm water. All feed is withheld for two hours after treatment. After-care is the same as given after treatment for bots.

We do not use oil of chenopodium as a vermifuge on our broodmares. Thin or weak animals may be safeguarded against the detrimental effects produced by the withdrawal of calcium from the blood when carbon tetrachloride is used by the subcutaneous or intramuscular injection of from 100 to 250cc of calcium gluconate, given prior to or at the time of administering carbon tetrachloride. The removal of botfly eggs from the hair on the legs, throat and elsewhere at time of bot treatment is essential. A 2% solution of phenol in water or a 2% solution of creolin is beneficial for this purpose.

Sanitation

The broodmare barn and surrounding area should be kept as sanitary as possible. The area should be well drained and free from débris and fecal material. Flies and rodents should be eliminated as far as possible. Ventilation should be adequate, yet free from draught; an abundance of window space is essential. The importance of dry standings cannot be over-emphasized. Clay standings and impervious walls are best suited for a broodmare barn, clay standings to be replaced once each year when mares are in pasture. The walls of the barn should be scrubbed thoroughly at the time of repairing the floor.

Bedding should be adequate, dry, and free from odors. At foaling time too much straw may become a hindrance: therefore, we usually provide a four-inch bed in the middle of the stall and bank the sides and corners.

All manure must be properly composted prior to spreading it on pasture to prevent the perpetuation of parasites.

The broodmare stall is about 14 feet square; sides straight and constructed in such a way that it may be cleaned easily. Double boarding is thought to be a hindrance to thorough cleaning. Each stall has an electric light and double doors.

Spaying Foals in the Field*

By C. N. LOGUIDICE, J. N. GONI and V. PESSACQ,
Buenos Aires, Argentina

General Considerations.—The vulnerability of the peritoneum of the horse to microbial infection is well known. This is true to such an extent that an abdominal operation is advisable only in well-equipped clinics, making use of all the provisions for asepsis and antisepsis—a condition that is, generally speaking, impracticable in ordinary veterinary practice.

Our experience, however, has shown that the peritoneum of young subjects of the equine species has an exceptional resistance; and that it is therefore possible to perform abdominal surgery in such subjects even under conditions precarious to hygiene, such as are encountered in rural practice.

The spaying of the mare has an influence on her character, converting her into a docile animal, and suppressing the period of heat, gestation, and lactation, so that this animal can be utilized in the same manner as a gelding, having the same aptitudes and submission to work, whether it is for traction, saddle, rural work, army, etc.

The surgical operation we propose can be performed by any veterinarian without requiring any specialization or special instruments. It can be performed in the open field or near the corrals where the mares and their colts are kept. The most convenient method of spaying young fillies is through the interior zone of the flank.[1]

The fillies we operated upon (12 in number) were from three days to two months old. Because of the proximity of the ovaries to the surface, the most propitious age is before 10 days. When the animal is more than 10 days of age, it is necessary to make a large incision in the flank to permit the introduction of the hand, a procedure that has its inconveniences; besides, it is necessary to subject the animals to prolonged fasting to empty the intestines, in order to avoid the presence of balls of fecal matter.

The best period of the year is, without doubt, the fall (March or April) although we found no inconvenience even when operating in May, June, November, and December (midsummer). Cicatrization of the operative wound results in from 20 to 30 days.

We express acknowledgement to our colleague Dr. José Villalba Maturana, who generously gave us the use of necessary animals on his property, the ranch "El Carmen," when we were assigned this work.

Preparation of the Animals.—The mares and colts are enclosed in a corral the night before the operation.

Choice of Terrain.—The operation should be performed in close proximity to the corral, in a place that has a little slope, or on a door or platform that is sloped, with the object of causing the abdominal viscera to drop forward; thus leaving the pelvic and prepelvic region free.

It is advisable to choose a location for the operation where the dust and dirt raised by the animals moving about in the corrals will not reach.

Preparation of the Instruments.—The indispensable instruments are: a bistoury, round pointed scissors 17 centimeters long, Kocher's forceps 15 centimeters long for the left or superficial ovary, clamp forceps 25 centimeters long for the right or deep ovary, and a Chassaignac's écraseur.

The list is completed by adding a pair of rat tooth forceps, hemostatic forceps, a Farabeuf separator, suture needle, silk or linen, catgut, etc.

Boil the instruments in a metal container. After the first intervention the instruments are kept submerged in a solution of disinfectant in order that they may not become contaminated.

---

*From the *Revista de Medicina Veterinaria*, May-June, 1938. Translated by J. M. Arburua.

[1] Technique of Captain Marcenac.

Restraint.—With the colts lying on the right side, tie the front legs and the right hind leg. The left hind leg is drawn back and held by a helper. It is not advisable to tie this leg because the straining of the animal may cause accidents.

Field of Operation.—The operation is performed in the lower part of the left flank, that is to say, the zone bounded above by the cord of the flank, in front of the hypochondrium, behind by the anterior border of the muscle, and below by the fold of the skin of the flank.

Shave a large area and disinfect with rectified alcohol or tincture of iodine.

Local Anesthesia.—We have always used for anesthesia the following solution:

Cocaine or novocaine.....	1.
Adrenalin solution 1-1000.....	5.
Distilled water .....200.	

The hypodermic needle should be six or eight centimeters long. The first injection of 10cc of the solution is made under the skin, inserting the needle in the direction of the great oblique muscle (m. obliqus externus abdominis). The needle is introduced in its entirety and the liquid is injected as the needle is withdrawn. The second injection, also of 10cc, is made intramuscularly, following the fibers of the lesser oblique muscle (m. obliquus internus abdominis), using the same technique as in the first injection. After three to five minutes the operative field is completely infiltrated.

In some countries male foals are not castrated and it is not regarded that there is any particular objection to stallions as work animals. In much of the tropics stallions are preferred for the saddle. In most countries stallion colts are castrated but fillies left entire. In Argentina the castrate of both sexes are regarded as superior to entire animals for work.

We have also practiced general anesthesia, using a peritoneal injection of chloral, but we feel that it is not necessary to have recourse to this procedure.

Operative Technique. First Phase.—Laparotomy of the flank. The operator, having asepticized his hands and arms with rectified alcohol, makes an incision 10 centimeters long in the lower region of the flank, obliquely, from below upward, and from the rear forward; that is to say, in the direction of the fibers of the great oblique muscle. Incise the skin and the great oblique muscle. The lesser oblique muscle now being exposed, place the end of the closed straight scissors in the center of the breach and with a firm quick movement perforate this muscle, the transverse muscle, and the peritoneum. Then draw out the scissors in an open position. There now remains a sufficient aperture to perform the second phase of the operation.

Second Phase.—Penetrate into the abdominal cavity with the index and middle fingers and half of the left hand and find the superior ovary (the left one), grasp it with the 15-centimeter, Kocher's forceps, and draw it through the incision. Then, with the same fingers and the left hand find the deep ovary, which is held with the 25-centimeter clamp forceps. In very young animals, this ovary can be brought very close to the abdominal incision.

The loop of the chain of the écraseur is run to the end of the clamp forceps, and, being careful to avoid intestinal loops, the deep ovary is picked up in the apparatus and slowly severed at the pedicle. Then the same procedure is followed for the left ovary.

Third Phase.—Place three or four deep sutures of catgut (plain or chromic) through the lesser oblique muscle, including all the wall and the peritoneum. The skin and the great oblique muscle are joined with a few sutures of linen or silk, well separated to permit drainage of the exudates. The wound is painted with tincture of iodine.

With the object of avoiding contact with

flies in the summer we have applied the following pomade:

Essence of mirbane	3.
Oil of pure juniper	10.
Formaldehyde	0.75
Lanolin	60.
Vaseline	60.

Aftercare.—It is essential to let the animals run with their dams, keeping them as quiet as possible, since moving about may cause a separation or rupture of the sutures, requiring subsequent intervention.

If the procedure outlined is followed most of the danger from the operation is avoided. Complete cicatrization occurs in from 20 to 30 days.

Jugular Slough Following Calcium Gluconate Injection

April 1, 1938, Dr. John S. Gray of Newton, N. J., was called to the New Jersey experiment station at Sussex to treat a case of milk fever; successful parturition having taken place March 30.

Upon arrival the subject was found to be a heavy producing, 5-year-old, grade, Guernsey cow. She was comatose, lying on her side with her head bent around resting on the left shoulder in the typical milk fever attitude; her temperature was subnormal; the respirations deep, slow and accompanied by groaning; pulse accelerated; mouth partly open with dry tongue hanging out.

Treatment consisted in first getting animal up on her sternum to prevent the possibility of bloat or mechanical pneumonia due to dysphagia. She was held in this position by using a bag of feed back of her. With a gravity flow intravenous outfit, a 14-gauge needle, 340 cubic centimeters of a calcium gluconate compound solution was given in the left jugular vein. This solution was previously heated to body temperature. Special precaution was taken to get all of the solution in the vein and to administer it slowly. The cow made an uneventful recovery; getting up 20 minutes after the injection. As customary, instructions were left not to milk her until 24 hours later, unless necessary to relieve pressure on the udder, in this case remove just enough to relieve the udder. It was noticed that the calcium gluconate compound solution did not mix properly with the blood and produced "a sort of block" adjacent to the needle in the vein. In making many intravenous injections, the previous condition of block has occurred, but never before with serious outcome. At this time the site of injection was massaged to facilitate the intermixing of the solution and blood.

Fig. 1. Showing the necrotic area two weeks after the intravenous injection

Fig. 2. Showing the cicatrix remaining after the wound shown in fig. 1 had healed.

Two weeks later Doctor Gray was again called out to this farm. A swelling had been noticed at the site of injection of the calcium gluconate solution. At this time the jugular vein with adjacent tissues had undergone necrosis and sloughed out leaving an open wound with shreds of tissue hanging down (Fig. 1).

The sloughing area was about eight inches long and three to four inches wide and included all of the tissues down to and including the vein. It was necessary to tie off the end of the vein to prevent further hemorrhage. Loose ends of tissue were trimmed out and the area disinfected with one teaspoonful of creosote solution to one quart of water. This solution was applied daily to the area until eventual complete recovery. However, a depression was left in the center of which a long scar remained (Fig. 2). The cow did not produce as well during the following lactation period.

HAROLD BURR, K.S.C., '39.
Manhattan, Kans.

Studies of An Atypical Strain of Brucella Abortus Isolated from a Naturally Infected Animal*

E. E. HAMANN and I. F. HUDDLESON,
East Lansing, Michigan,
Department of Bacteriology,
Michigan State College

History of Herd.—This herd comprises some fifty Jersey animals, most of them registered. The owner signed up with the federal Bang's disease project in July, 1935. In spite of frequent testing and immediate disposal of all reactors, new reactors were found on subsequent tests. The results of the tests are shown in Table I.†

TABLE I

Tests	Date	Number of Animals Tested	Reactors	Suspects
Initial test	7/31/35	46	4	1
First retest	10/30/35	34	2	2
Second retest	2/24/36	50	1	0
Third retest	6/10/36	45	2	3
Fourth retest	10/ 5/36	45	9	0
Fifth retest	11/12/36	54	0	1

All negative animals (except a few calves which were vaccinated with strain 19 by Dr. W. A. Rader of the B. A. I.) were vaccinated with the Huddleson vaccine Nov. 16 and Nov. 30, 1936. Blood samples were collected from the whole herd at frequent intervals and negative animals were again vaccinated Oct. 1 and Oct. 15, 1937. Reactors were not disposed of during this period unless they became unprofitable. The results of this procedure are shown in Table II.

TABLE II

Date of Test	Number of Animals Tested	Reactors	Suspects
2/22/37	50	1	5
5/21/37	48	3	3
9/ 8/37	49	8	1
12/17/37	57	11	7
2/ 7/38	54	12	4

Since it was apparent that vaccination failed to check the spread of infection the vaccination project was discontinued in February, 1938. One of the heavily-infected animals was purchased to study the nature of the organism involved in this herd. This cow had been vaccinated with the Huddleson strain in November, 1936. She gave a positive reaction in the 1:50 dilution in February, 1937 and was positive in the 1:400 dilution in May, 1937. She aborted an eight-month fetus May 7, 1937, and remained in the herd until purchased in January, 1938.

Results of Study.—*Brucella abortus* was isolated from the milk of all quarters of the udder. The culture required CO_2 for primary and subsequent growth. The organism was classified as a strain of *Br. abortus* by the dye differentiation method. Its agglutination reactions toward negative and positive sera were normal. Dissociation tests proved it to be a smooth strain. The colonial appearance and cultural characteristics of the organism also were those of a normal strain of *Br. abortus*.

A suspension of the organism corresponding to the density of tube I of the McFarland nephelometer was prepared and one drop of the suspension was placed in the eye of ten normal guinea pigs Jan. 15, 1938. The guinea pigs were killed Mar. 30, 1938. Duplicate cultures of the liver, spleen, and kidney were made on liver agar and incubated in an atmosphere of 10% CO_2 at 37.5°C. for three days. Blood was collected and the agglutination titer determined by the rapid method. (See Table III.)

This experiment was duplicated on another group of ten guinea pigs Oct. 28, 1938, with these variations: The tube 1 suspension was diluted five times with sterile physiological saline solution and blood samples were obtained from the guinea pigs at intervals. The animals were killed and cultured Jan. 4, 1939. The results of this experiment are set forth in Table IV.

†Results obtained from the Lansing Office of the U. S. Bureau of Animal Industry.

*Journal Article No. 341, N. S. Michigan Agricultural Experiment Station. This study was supported by a grant from the U. S. Bureau of Animal Industry.

TABLE III

Guinea Pig No.	Agglutination Reaction	Cultural Findings	Macroscopic Lesions
1	–	+	+
2	–	–	–
3	P 1:25	+	+
4	T 1:25	–	–
5	–	+	–
6	+ 1:25	+	+
7	+ 1:100	+	+
8	P 1:25	+	–
9	–	+	–
10	–	–	–

+ = Complete agglutination; positive culture; positive lesions.
P = Incomplete agglutination.
T = Trace agglutination.
– = No agglutination; negative culture; no lesions.

Pellagra in a Hereford

The discussion of porphyrinuria in a yearling Hereford in the February issue (*Vet. Med.* 34:2, p. 102) is a most interesting one. This is very suggestive of a nicotinic acid deficiency and is the first one in cattle that has come to my notice. Photosensitization is a common characteristic of nicotinic acid deficiency (pellagra) in man, and one frequently sees dermatitis on the face and neck that stops abruptly where the skin is protected by clothing. It is not just the light, but sunshine—apparently the ultra-violet rays—that precipitate the dermatitis.

It is an interesting fact that the symptoms of nicotinic acid deficiency in man, dog, and swine differ in many respects. It should not be surprising, therefore, that the case described does not parallel the symptoms of either pellagra or black tongue. If it is a case of nicotinic acid deficiency it seems to resemble pellagra in man more closely than the symptoms of blacktongue. In man porphyrin in the urine is also a common symptom.

W. O. FROHRING

Cleveland, O.

TABLE IV

Guinea Pig No.	Agglutination Reaction 11/14/37	11/28/37	12/12/37	1/4/39	Cultures	Macroscopic Lesions
1	T 1:25	P 1:50	+ 1:25	+ 1:25	+	–
2	T 1:25	P 1:50	Died			
3	P 1:25	+ 1:100	Died			
4	+ 1:25	+ 1:100	+ 1:400	+ 1:400	+	+
5	Died					
6	Died					
7	+ 1:50	+ 1:100	+ 1:100	+ 1:400	+	+
8	+ 1:25	Died				
9	+ 1:50	+ 1:100	+ 1:100	+ 1:400	+	–
10	+ 1:25	+ 1:25	+ 1:25	+ 1:25	+	–

+ = Complete agglutination or positive culture.
P = Incomplete agglutination.
T = Trace agglutination.
– = No agglutination.

Discussion.—Most of the guinea pigs in the first group and at least two, (Nos. 1 and 10) in the second group were infected with *Br. abortus* without showing an appreciable agglutination titer. While a few showed macroscopic lesions in the liver and spleen, none of these lesions were extensive. It is the authors' opinion that this same phenomenon was taking place in the herd of cattle and that for this reason it was impossible to eliminate the infection from the herd by either the slaughter or vaccination methods. Infected animals could have been in the herd for some time before they were detected by the agglutination test.

The strain of *Br. abortus* used in the vaccine with which the animals were treated is an intermediate rough form. It does not produce an agglutination reaction in experimental laboratory animals or cattle. During ten years of study it has never been found to establish itself in any species of animal.

Leading live stock producers are building better markets by following the best methods of veterinary service in maintaining herds free of all contagious diseases. Communities are establishing reputations for live stock free of disease, and graduate veterinarians are making this possible.—*Live Stock San. Com.*, Sioux City, Iowa.

Observations of **Anaplasmosis** as it occurs in Puerto Rico

By H. L. VAN VOLKENBERG,*
Mayaguez, Puerto Rico,
Formerly Parasitologist, Puerto Rico Agricultural Experiment Station

Anaplasmosis is an important disease of cattle in Puerto Rico. The disease so far as the clinical and pathological findings are concerned does not present anything which differs markedly from published descriptions. However, some of the manifestations of anaplasmosis as observed in Puerto Rico seem to vary from the usual conception of the disease. The diagnosis of the disease has been based on finding the organism *Anaplasma marginale* in the red blood corpuscles. *Anaplasma centrale* has not been encountered by the writer in Puerto Rico. In connection with this disease, it should be mentioned that tick fever caused by the piroplasms *Babesia bigemina* and *Babesia argentina* also occurs in Puerto Rico.

The cattle population of the island consists of the so-called native animals, a large number of individuals of the improved breeds of dairy cattle, and crosses between these two groups. The native animals which have characteristics of a distinct breed are the descendants of early importations from Europe, probably Spain. A number of importations of Brahman cattle have been made at different times. These animals have been crossed with the native cattle and it is probable that all the native stock carry some Brahman blood. The improved breeds of dairy cattle have been introduced from the continent of North America at different times during the last 30 years. The three groups of cattle show considerable variation in their susceptibility to anaplasmosis.

In connection with anaplasmosis and tick fever the agents of transmission should be mentioned. In Puerto Rico there are but three distinct species of ticks found on domestic animals, viz., the cattle ticks, *Boophilus annulatus* and *B. australis*, the tropical horse tick, *Dermacentor nitens*, and the brown dog tick, *Rhipicephalus sanguineus*. In Puerto Rico only one tabanid, *Chrysops variegata*, is common, and this fly is not abundant. Several other species of the Tabanidæ are reported, but all are of rare occurrence. It is doubtful if horseflies, because of their relative scarcity, are of any importance in transmitting this disease in Puerto Rico. The cattle tick is regarded at this time as the primary vector of tick fever and of anaplasmosis.

If the campaign which was started in April 1937 to eradicate the cattle tick in Puerto Rico is successful, it will probably eradicate both the cattle tick and the horse tick. Thus the dog tick will remain as the only possible tick vector of anaplasmosis.

Among recently imported animals, anaplasmosis usually follows tick fever within a few days or a few weeks. Dairy cattle introduced from the continent are very susceptible to the disease and probably none of them ever escape an acute attack. Usually these animals are over two years of age and most of them have been obtained from the east coast of the continental United States as far south as Virginia. These imported animals have not been preimmunized to anaplasmosis and tick fever previous to shipment. Because of the prevalence of tick fever and anaplasmosis in Puerto Rico the introduction of susceptible cattle into this island is a hazardous undertaking.

Unlike tick fever, anaplasmosis is a rather common and serious disease among the improved breeds of dairy cattle raised on the island. The animals attacked are usually mature cattle that have been exposed to tick infestation since birth. It is assumed that these animals at various

*Now Parasitologist, School of Veterinary Medicine, Agricultural and Mechanical College of Texas, College Station, Texas.

times throughout their lives become infested with ticks. It is known in most instances that the animals in the herds in which outbreaks of anaplasmosis have occurred were being treated periodically or intermittently because of tick infestation. The usual practice in these herds is to dip or spray the entire herd with arsenicals as soon as the ticks become readily noticeable on some of the animals. In the station herd, which consists of purebred Guernsey cattle, it has been observed that certain cows apparently are more susceptible than others to tick infestation. Examinations of this herd have demonstrated that if the ticks become readily noticeable on the more susceptible individuals, it is not difficult to find specimens on all the other animals. Since 1930 several animals in this herd have suffered attacks of anaplasmosis. Although no serious outbreak has occurred, at different times two valuable cows were lost from the disease. From the observations and examinations of this herd apparently all of the mature animals have been infested with ticks numerous times throughout their lives.

Occasionally a sporadic case of anaplasmosis is detected in a young animal, but among the outbreaks that have been observed in dairy herds it is the mature animals that are affected. Out of a total of more than 20 outbreaks of anaplasmosis in dairy herds examined by the writer, without exception the cattle which had reached an age of 30 months or more were the only animals which showed noticeable symptoms of the disease. The younger animals in these herds did not show symptoms of the disease although daily temperature readings and blood examinations were not made. No attempt is made to explain the occurrence of the disease in the mature animals and not in the young stock. The transfer of the organism producing the disease mechanically by instruments used in various operative procedures has been investigated and eliminated as a possibility among the positive cases that have been observed by the writer.

The disease among the improved breeds born and raised on the island appears sporadically or in enzoötic form. In a herd of 20 dairy cows three or more of the animals have shown evidence of the disease at the same time. The disease has been observed to appear in a similar manner in widely separated herds at approximately the same time. The number of animals attacked, the severity of the disease, and the mortality vary considerably during different years. In 1935 the disease was more common and more severe than was observed during 1936 and 1937. Anaplasmosis may occur any month of the year among imported stock, but among the established animals it is observed more frequently during the season in which the cattle tick is the most abundant; which corresponds to early spring and summer in the north.

Other than a variation in severity during different years, the virulence and probable mortality of anaplasmosis depend upon the class of animal attacked. The highest mortality occurs among the dairy cattle raised in the United States and introduced into Puerto Rico as adults. Other than the new arrivals, the greatest losses occur among the improved breeds of dairy cattle which have not been crossed with the native stock and which have been on the island for only one or a few generations. Crosses between the improved breeds and the native stock are susceptible to anaplasmosis, but the disease is usually unimportant among such animals that carry one-fourth or more of the native blood. The native cattle, including dairy cattle and work oxen, seldom if ever show noticeable symptoms of the disease.

As an example of the seriousness of the disease among the dairy cattle born and reared on the island an outbreak of anaplasmosis occurred during 1935 in the dairy herd of the College of Agriculture, University of Puerto Rico, at Mayaguez. This herd consisted of purebred animals and animals not more than one-eighth native. Seventeen of a total of 24 milk cows showed symptoms of the disease. Two or three of these animals were known to have had previous attacks. None of the young stock showed clinical evidence of the disease. Six deaths occurred on the following dates:

February 5, March 7, March 11 (2), March 25, and August 10. The ages of the cows that died were 40, 48, 56, 68, 74, and 108 months. The history of this outbreak is rather typical, but the losses in this herd at this time were greater than usually occur among established animals. However, very few herds in Puerto Rico contain such a high proportion of the blood of the improved breeds of dairy cattle.

As mentioned previously, recurrences of anaplasmosis in the same animal are known to occur. The records are of imported cattle and of animals born and reared on the island which have been exposed to tick infestation since birth. The first record of a recurrence of the disease was obtained in 1932. In May 1931 a Holstein cow raised on the island showed symptoms of anaplasmosis. A blood examination was made and anaplasma bodies were found in the red corpuscles. In the summer of 1932 this cow again showed similar symptoms. Samples of the blood from this cow at this time were forwarded to the Zoölogical Division of the United States Department of Agriculture. The report dated October 21, 1932 states: "The blood smears from the Holstein cow sent under date of September 28, show definitely that the animal suffered from anaplasmosis."

Since 1932 two purebred Guernsey cows in the station herd have suffered two attacks of anaplasmosis. One of these animals showed symptoms of the disease on two consecutive periods of freshening. In all cases the diagnosis of the disease was made on finding the organism in the blood.

One record in which a Guernsey cow apparently suffered three attacks of anaplasmosis is available. This cow approximately four years of age was brought from San Juan and placed in a herd at Mayaguez. The previous history of this cow is not definitely known, but apparently she had been born and raised on the island. A few weeks after arrival in Mayaguez in November 1933 the cow suffered an attack of anaplasmosis as verified by blood examinations. During March and April 1935 four cows in this herd showed symptoms of anaplasmosis and the organisms were found readily in the blood of each animal. The Guernsey cow was one of the four animals attacked. In September 1935 this cow dropped a calf and at the time showed a fever temperature and other symptoms that could not be ascribed to a mild case of mastitis or the other usual complications that may follow parturition. Blood smears were taken and a few anaplasma bodies were found in the red corpuscles.

Upon making examinations of sporadic cases and outbreaks of anaplasmosis in a herd it is not unusual to have the owner say that this or that animal had the same disease a year or two before. Such evidence unsupported by blood examinations is not conclusive, but the animals subject to attack by anaplasmosis are usually valuable cows and the owners naturally keep them under very close observation.

Apparently recurrences of the disease are most liable to occur among the more highly susceptible imported cattle as compared with the established animals. Recurrences or relapses in the imported animals are known to follow within a few months after the first attack as well as at a later date. Dr. A. A. Alvarez of the University of Puerto Rico reports verbally that recently a Brown Swiss bull introduced from the continent suffered three attacks of anaplasmosis within a period of eight months after arrival on the island.

Summary

The native stock in Puerto Rico, including the dairy cattle and work oxen, are remarkably resistant to both tick fever and anaplasmosis. Apparently their immunity to anaplasmosis is as solid and permanent as their immunity to tick fever. Dairy cattle of the improved breeds raised on the island develop, as elsewhere, a natural immunity to tick fever. With anaplasmosis such a naturally immunity is developed to a lesser extent and the disease is rather common and important among these animals. With the exception of an occasional, sporadic case of anaplasmosis in a young animal the disease as observed among the animals born and reared in the island occurs only in mature cattle. Recurrence of the disease in the same individual is known to occur.

Rickets in Calves

Rickets, as a disease of domesticated animals, occurs more frequently in pigs and chickens than in other farm animals. However, unthriftiness, faulty skeletal development, and even sudden losses in calves not infrequently occur as a result of rickets. Especially during the winter months when the antirachitic value of the sunlight is greatly reduced, difficulty from this source must not be overlooked. Winter sunlight has only one-eighth to one-fifth the antirachitic value of summer sunlight. Furthermore, the cloudy weather which prevails during much of the winter reduces further the benefit derived from sunlight.

Rickets is due to (1) a lack of or an improper balance of minerals in the ration; (2) a lack of vitamin D (supplied by direct sunlight or by fish-liver oil or other products); (3) a combination of these two factors; or (4) parathyroid dysfunction. Under average conditions, ordinary farm rations contain sufficient minerals for the needs of young calves. However, average farm rations may not contain adequate amounts of vitamin D, and young animals may suffer serious consequences unless this factor is supplemented.

In several outbreaks coming to our attention recently, the calves developed convulsions and several died while having one of these attacks, while in other instances, the calves survived the attack and ate again in a few minutes. Chronic bloating is another common symptom. Unthriftiness, rough hair coat, arching of the back, tender feet, and walking with a stiff, stilted gait, enlargement of joints and outward or forward bowing of the legs are recorded. Spasmodic twitching of the muscles of the lips, neck, and face were observed in one outbreak.

The internal organs of calves dead of rickets usually show no changes; however some authorities record marked enlargement of the extremities of the long bones and "beading" of the costochondral articulations. The ribs, spongy and easily bent, break without the familiar "snap" of a normal rib.

Examination of blood plasma for calcium and inorganic phosphorus content may be a valuable diagnostic procedure. Blood samples from three calves in one outbreak showed normal inorganic phosphorus, but the calcium values were approximately one-half normal. However, in some cases of clinical rickets, the calcium and phosphorus values may be within normal limits, while in other cases low blood phosphorus values may be shown.

There is a wide range between a normal individual and one showing clinical rickets, permitting the suggestion that many young calves may suffer from a subclinical form of the disease. Calves showing clinical symptoms of rickets are usually in the advanced stages of the disease and require special treatment while preventive measures in the herd can be applied with effective results. Rations should be checked carefully for mineral content. Rations made up from four or five plant sources are more likely to contain the necessary elements than rations made up from one plant source. During the winter months, with reduced amount of antirachitic sunlight, calves may require vitamin D supplement in the form of cod-liver oil.—*Animal Pathology Division, University of Illinois.*

* * * *

It pays the live stock industry of any section to build and maintain a reputation for having live stock free from disease.

* * * *

Anthrax has occurred in recent years, in more than 100 counties of the Northwest area. It caused a loss in 1937 estimated at three million dollars.

* * * *

New Mexico established the first live stock sanitary board in the United States in 1895. It is known as the "Cattle Sanitary Board of New Mexico." There are now 16 states with non-political live stock sanitary boards which administer the animal disease control and live stock sanitary laws of their respective states.—*Live Stock San. Com.*, Sioux City, Iowa.

The Suffolk is a typical mutton type sheep, with no horns, and perhaps the darkest face of any breed.

The Southdown is one of the largest of the medium-wool, mutton breeds. It is dark-faced and hornless.

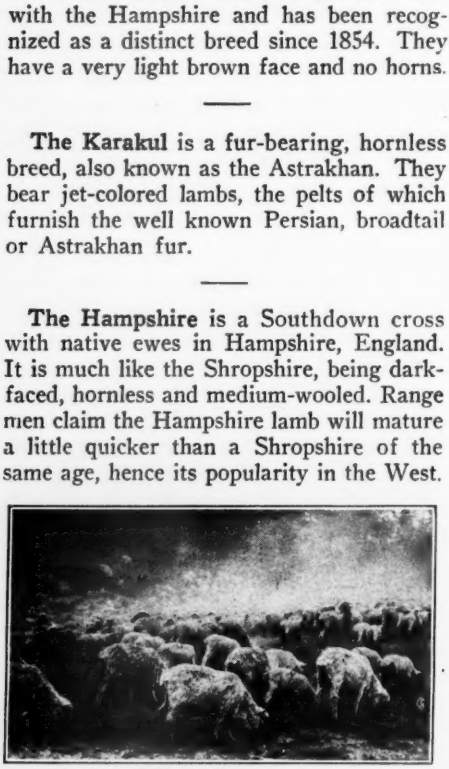
Lesser Known Breeds of sheep include over a dozen breeds raised in various regions of the world, mostly in the British Isles.

The Cheviot is one of the most beautiful of all breeds of sheep, with the alert appearance of a thoroughbred. They are white-faced and hornless.

The Oxford is a cross of the Cotswold with the Hampshire and has been recognized as a distinct breed since 1854. They have a very light brown face and no horns.

The Karakul is a fur-bearing, hornless breed, also known as the Astrakhan. They bear jet-colored lambs, the pelts of which furnish the well known Persian, broadtail or Astrakhan fur.

The Hampshire is a Southdown cross with native ewes in Hampshire, England. It is much like the Shropshire, being dark-faced, hornless and medium-wooled. Range men claim the Hampshire lamb will mature a little quicker than a Shropshire of the same age, hence its popularity in the West.



Sheep on the Range.

The Dorset was recognized as a distinct breed in 1840. It is a white-faced, mutton type. Both sexes possess large horns. They produce two crops of lambs per year, and are very hardy.

The Cotswold is the largest of all breeds, and one of the oldest of English types. Mature rams average 250 pounds, and ewes around 175. They are long-wooled, white-faced and hornless.

The Leicester (lester) is the oldest of all English breeds, dating back to 1760, when Bakewell began his famous work. Very large, with no horns and white faces, they belong to the long or coarse wool type.

The Corriedale was developed in New Zealand in 1880 by crossing Lincoln rams with merino ewes. The lambs furnish fine mutton, being known in the English trade as "Canterbury lamb." They are light faced and hornless.

The Shropshire is thought to be a Southdown cross, recognized as a distinct breed in 1859. It is medium-wooled, hornless and dark-faced. The ewe is a good mother, a hardy rustler, and one of the most popular of farm breeds.

The Rambouillet (ram-boo-yay) is often called a "French merino." This breed is much larger than the merino, very hardy, and is one of the most popular breeds of range sheep. A well matured ram weighs around 250 pounds, and the average ewe 140. They have light faces, and the rams possess large "Gabriel horns."

The Merino is the oldest known breed of sheep, and has been used as a foundation stock all over the world. According to the fineness of the wool they are divided into three classes: A, B and C. A merino ewe of average size weighs from 90 to 120 pounds, and a ram from 125 to 200 pounds. They have white faces and the ram has horns.

Anemia in Suckling Pigs

I have a problem on which I will appreciate some help. I have been treating swine erysipelas here since 1934, and have had a wide experience, but I have a situation now that has me stumped.

In 1936 a client of mine had his first outbreak of swine erysipelas. I treated all hogs with two doses of serum given five days apart, and all went well. The pigs were fattened, shipped, and sold. The sows farrowed later, and when the pigs were about four months of age erysipelas broke out among the pigs. Again two doses of serum were given, and again everything went along nicely.

Fourteen sows began farrowing about September 15th last, and had 125 normal, healthy pigs. When they were about three weeks of age they started dying. After making post-mortem examinations of several of the pigs that had died, I diagnosed the trouble as erysipelas. Accordingly we gave each pig 10cc of serum, and repeated this in five days, but they continued to die. I made several more autopsies, and found them to be anemic, icteric, and full of fluid in the abdominal and pleural cavities; fibrous growths on the heart; the liver enlarged, gray in color, and swollen. I told the owner that the lesions we found were the result of damage the erysipelas had caused before we treated the pigs. We lost about 30. All the remainder are doing nicely.

About November 15th, 11 other sows farrowed 100 normal, healthy pigs on this same farm. All the pens had been thoroughly disinfected and fresh bedding supplied. These November pigs, when they were five days of age, were given 10cc of serum each. Four days later the dose was repeated, and the next week they were given a third 10cc dose, as some had begun to die.

We have lost about 20 of these with the icteric condition mentioned. Some of them develop a diarrhea before death. On post-mortem examination I find an enlarged liver and abundant fluid in heart and lungs. The lymphatics and other organs are apparently normal. Three of these litters never did develop any kind of trouble.

All of these sows are cholera-immune and have been treated with erysipelas serum three times. They are fed ground maize, wheat shorts, tankage, and cottonseed meal, with one ounce of Watkin's hog tonic to each batch of this slop. These sows are apparently all healthy. I would like to know what you think of the pigs.—*S. R. D.*, Texas.

Comment.—You have omitted some information that would be quite helpful in making a diagnosis. Are the pigs kept on a concrete floor, or are the lots quite sandy? Did you find enlargement of the spleen? Generally speaking, there are at least three conditions in which anemia and icterus are prone to occur: (1) pig anemia, (2) paratyphoid infection, and (3) anaplasmosis-like disease.

Pig anemia is primarily a deficiency of iron or iron and copper. In this section of the country, anemia occurs in pigs that are kept on concrete, wooden, or sandy floors. This same condition may occur in pigs that are on dirt floors deficient in iron. Iron deficient anemia can be prevented by providing iron and copper in the pigs' ration. Iron and copper will also be of value as a curative agent, provided the condition is not far advanced.

Anemia and icterus may occur in swine infected with paratyphoid organisms. As a rule, the paratyphoid anemia affects only a portion of the herd and is usually characterized by an enteritis.

Anemia associated with an icterus is also characteristic of a condition that is called "anaplasmosis-like disease". This malady affects only a small portion of a herd of swine. An enormously enlarged spleen is of common occurrence in this malady. This condition responds fairly well to the use of Fowler's solution, using dram doses daily for a 100-pound shote, increasing or decreasing the dose in proportion to the size of the hog.

The feed that is provided for these hogs is apparently sufficient; however, there may be a deficiency of vitamins as well as of minerals. If it is practicable to change the feed, that may be of value.

It is my belief that an iron deficiency is of major importance in this case.—*A. T. K.*

Hazards Occurring Among Garbage Fed Swine

P. J. GERMANIO, Manhattan, Kansas,
Kansas State College, 1939

THE hazards occurring among swine that are fed garbage varies with the type of garbage. There are several common types of garbage—at one extreme is the "rich" type, from hotels and restaurants, which is usually stored in a sanitary manner and is collected daily; at the other is that very poor type, from the slums of a city, which is kept in unsanitary containers and is usually mixed with trash. In between these extremes there may be included the light household garbage; the dry garbage from fruit stores, chain stores, and produce grading plants; and the various types of garbage from canneries, fish pounds, fish markets, bakeries, and other concerns.

Most garbage feeders collect several types of garbage, and usually feed several sizes of swine. The rich garbage, from hotels and restaurants, is fed to the larger shotes to be fattened for slaughter. Brood sows and pigs do not do well on this rich food, therefore experienced feeders have learned to feed their sows and pigs the lighter types of garbage and fish scraps. Fish should never be fed to fattened hogs because of the fishy flavored pork produced by it. When much fish has been fed to hogs it requires about two months on other feeds with no fish at all before the fish odor disappears from the flesh.

Doctor Jay[1] writes, "If there is any essential for growth lacking in garbage it has not been detected, and therefore optimum growth should be secured. However when put into practice the results are often disappointing as many hogs so fed are pitiable objects of the feeder's indiscretions and die of inanition." He attributes this to an allergic reaction and further adds that unborn pigs are sensitized by improper preparations for feeds and that after sucking the first milk some manifest a violent reaction and die. Most large-scale, garbage feeders encounter this hazard occasionally. They commonly refer to it as "poison milk" in sows. Most men have found they can reduce farrowing hazards considerably by not allowing the sows to get too fat; and by feeding only the lighter types of garbage, and cutting down the amount several days before farrowing. Very little is fed on the day the sow farrows. After farrowing the amount fed is gradually increased to normal.

When grain-fed swine are put on garbage alone, usually some will not do well and some will go from bad to worse and die. On the other hand if garbage fed swine are put on grain, at first they do not care for the grain, but once they start eating the grain they do well. In sections of the east raw garbage alone is fed successfully because the pigs are either all raised on the garbage feeding plant or they are bought from other garbage feeders.

It is common to observe lame animals among garbage fed swine. In many instances it is due to injury from various objects in the garbage. Thumb tacks or other tacks are easily picked up from the feeding platforms, which are usually constructed of concrete. These tacks may puncture the sole or bulb of the claws, and enter the sensitive tissues. Occasionally pigs step into circular portions of sawed bones, and the ring of bone slips over the toes and encircles the pastern where it fits tightly. The sharp edges of the bone cut through the skin around the pastern. In several days edema of the local area and toes develops and the bone becomes partially embedded in the skin. A metal ring or a rubber band may cause a similar condition. Injuries from broken glass and tin cans may cause lameness. Often the circular flap from the open end of a can is pushed into it. When a pig steps into such a can its foot may become caught and cut by the sharp circular flap. In small pigs the claws may be cut off entirely. Wounds around the feet may become infected with tetanus organisms. The lamenesses, which are due to

[1] N. A. Veterinarian, June 1930, p. 49.

injury, usually are without the stiffness and swelling of the joints, observed in lamenesses due to various diseases.

An uncommon but interesting case was observed by the writer in a herd of about a hundred, nine weeks old pigs. One of the thriftiest pigs was observed breathing with difficulty, making a snuffling noise, and his nose was somewhat swollen and of a dirty greyish color. After running a short distance this pig began breathing through his mouth. On examination a small, broad rubber band was found just behind the snout. Edema and pressure necrosis had already set in. The rubber band was removed and the wound was painted with a 4% colloidal iodine solution. The outer surface of the nose sloughed off after several days. The pig recovered nicely.

Wire hoops from lard tubs or barrels may slip over a hog's head and around the neck. This hoop may get caught or become entangled with various objects, and as the hog fights to get away he may be choked to death. A similar wire hoop may slip behind the shoulders, where it may not be observed, and as the hog grows or becomes fatter the hoop becomes tighter producing a severe wound around the entire body. Such injuries are not common.

Another peculiar case, observed by the writer, occurred in a brood sow. She was emaciated and yet vigorous and hungry. She would chew up some food and then throw it out of her mouth by means of tongue movements and by rotating the lower jaw with the mouth open. Occasionally she would try to vomit. With a mouth speculum a string could be seen around the base of her tongue. The string was grasped with a forceps and pulled out. It was about two feet long, having a loop on one end, which encircled the base of the tongue and a portion of a fish head on the other end, which had been swallowed. After removal the sow had no more trouble.

Of the foreign bodies probably broken glass causes most death losses. It is not uncommon to see a hog, leave the feeding platform, salivating and bleeding from the mouth, vomiting or trying to do so, holding neck stiff and mouth open, and usually grunting with a harsh tone of voice due to either a piece of glass, razor blade, needle, fish bone, fish hook, steel wool, pin, thumb tack or any other sharp foreign body lodged in the throat. These foreign bodies may cause much trouble in the intestinal tract also. Often the healthy hog, which is found dead in the lot, will show, on autopsy, a foreign body puncturing the stomach or intestines (usually the small intestine)—thus causing peritonitis and death. Larger objects may choke the animal or bring about occlusion of the digestive tract.

Various poisons and caustics occasionally occur in garbage. Lye or soap powders may occur in large quantities, especially in garbage from hotels. The lesions produced are similar to those produced by any caustic alkali. Salt poisoning may be encountered from pickle brines and from spoiled pickled fish; in fact from any type of garbage. Arsenic and phosphorus poisoning may occur from rat poisons, which are disposed of in the garbage. Also lead and arsenic may be obtained from paint buckets, which are commonly used as garbage pails in the slums of cities. Strong disinfectants and alkaloids and those poisons maliciously added to the garbage may cause severe losses.

There is also the possibility of ptomaine poisoning from garbage—referred to among garbage feeders as "garbage poisoning." Mark Welsh[2] mentioned a city-bred man who got a case of "easy money fever" and started to feed fifty hogs on garbage. Due to an argument, the garbage was not collected for several days, and spoiled. When it was fed, several hogs died and others became sick. This is an example of garbage poisoning; also of how costly poor management may be to the feeder.

Infectious diseases of garbage fed hogs are quite similar to those of grain fed hogs. However, several infections occur more commonly among garbage fed hogs, due mainly to infected meat scraps in the garbage. The hog cholera problem is being checked on most garbage feeding farms, since every intelligent garbage feeder sees

[2] Veterinary Medicine, Dec. 1934, p. 523.

to it that every pig is properly vaccinated. Trichinosis is much more common among garbage fed than among grain fed hogs. Dr. L. W. Goss[3] states that in examining several thousand hogs, about 5% of the garbage fed hogs and only about 1% of the grain fed hogs were found to be infected with trichina.

Cooking the garbage would reduce trichinosis among hogs a great deal and consequently reduce it among humans. However, the cooking of garbage is costly to garbage feeds since it does not increase the gains made by the swine, and yet is expensive in labor and fuel cost. Under the present conditions it would probably make garbage feeding unprofitable. Furthermore, a law compelling the cooking of garbage, would be difficult to enforce since most garbage feeders would not cook the garbage if they could get by without doing so. On the other hand, if every garbage feeder was compelled to cook the garbage most of them should not seriously object as far as the expense is concerned. After all, the garbage is removed from most cities through competitive contracting bids. If the cost of feeding garbage were increased for all garbage feeders, naturally cities would have to pay more to have the garbage collected and hauled away and the large hotels, which are being paid for their garbage now, would have to take a lower price. In other words the public would be indirectly paying for their own protection against trichinosis; but it would be worth it since trichinosis is a serious hazard to the public health.

Thoroughly cooking garbage would also decrease the amount of infectious diseases transmitted through raw garbage; it would decrease the number of flies and other insects, which hatch from eggs laid in the garbage; it would decrease the possibility of ptomaine poisoning; it would increase the palatability of some types of garbage; it would remedy a weakness of meat inspection making an inspected piece of pork actually what is implied—safe to eat—raw *or* cooked, and it would probably decrease the spoiled garbage odors.

[3] Veterinary Medicine, March 1938, p. 130.

Hemoglobinuria in Calves

A client of mine has lost several calves and one old cow. A constant symptom was hemoglobinuria.

The cattle on this farm had been and were being fed alfalfa hay, some corn and oats. In addition, the smaller calves were getting some milk twice daily.

The symptoms were: temperature up to 104° F. and hemoglobinuria. The affected animals weakened and usually died three or four days after the first symptoms.

Autopsy revealed a general anemia, congestion of the kidneys and bladder, but no hemorrhage in any of the tissues.

Thinking these cases were an atypical hemorrhagic septicemia, the entire herd was vaccinated. Phenosulphonate tablets and bismuth, subnitrate, Epsom salt, castor oil, ginger and gentian were given, but without benefit.

Have you any suggestions as to cause and treatment?—*C. L. W.*

Comment.—The following conditions may be given consideration in this problem: pyelonephritis, anaplasmosis, and icterohemoglobinuria (red water).

Pyelonephritis is ruled out, as the characteristic kidney lesions were absent; further, pyelonephritis is commonly a disease of mature cattle, while chiefly calves were affected in this outbreak.

Anaplasmosis may evidence hemoglobiuria in a small percentage of cases. However, it is primarily a warm weather disease transmitted by ticks, flies, etc. Therefore, it does not seem probable that the malady was anaplasmosis.

Ictero-hemoglobinuria is characterized by sudden onset, high temperature, hemoglobinuria, and death in 24 to 36 hours. Autopsy reveals bloody discharge from body openings, hemorrhages in mucous and serous membranes, and in the subcutis. Hemoglobin in the urine occurs in practically all cases. The cause of this malady is the *Clostridium hemolyticus bovis*. The symptoms and lesions are quite different from those you have described, and it is evident that the disease you described is not red water.

Polyuria in a Cat

A female Persian cat was spayed a little over a year ago and shipped from Oklahoma to its owner in Pennsylvania. Ever since that time it has been drinking large quantities of water and urinating profusely. If water is not available at all times, it cries until water is provided.

The cat seems to be healthy in every other way, except that it occasionally screeches, for no apparent reason. The urine shows no pathological condition, but because of the excessive amount the specific gravity is only slightly higher than that of water. Can you give me any information about this case?—*T. D.*

Comment.—This condition appears to be due to some nervous disturbance, and it would probably be difficult to obtain any favorable results from treatment. Fluidextract of valerin (five minimum doses in a dram of water, three times a day) might be worth a trial.—*J. A. C.*

The condition described apparently involves the kidneys, bladder, or gastrointestinal tract. Since cats are easily examined by palpation, a routine examination is suggested to detect the possible presence of an enlarged kidney or some bladder condition. Temperature readings and an investigation of the kind of food the animal is receiving might also reveal something.

If such procedures throw no light on the matter, I would recommend giving soda mint tablets, each tablet containing sodium bicarbonate, 4 grains, ammonium carbonate and oil of peppermint q. s. One tablet should be administered morning, noon, and night. The diet should include cooked cereals, baked egg custard, and soups, and all the water desired.

If at the end of 10 days there is no response to this treatment, an exploratory operation is indicated.—*J. G. H.*

* * * *

How could a veterinarian intervene successfully in animal healing if he were not instructed in the principles of the latest knowledge of nutrition and hygiene of domestic animals?—*Valentin Stang.*

Dystocia in a Cow Due to Hydrocephalus

September 30, 1938, the ambulatory squad of Kansas State College was called to attend a cow which had been in labor for nearly 12 hours. This was her second pregnancy; the first, by the same sire, having resulted in a normal calf.

An initial injection of 20cc of 2% procaine was administered epidurally with an additional 10cc before delivery was completed. The fetus was presented anteriorly. A fluctuating enlargement of the head almost as large as a basketball had prevented the passage of the fetus through the pelvic canal. When punctured it yielded about two gallons of fluid. The bones of the skull, which had grown irregularly upward to form a tulip-like cavity, were broken down with an obstetrical chisel, the fetus then decapitated, the two anterior limbs secured, and delivery effected.

A post-mortem examination revealed a distension of the lateral ventricles of the cerebral hemispheres as the main pathological lesion.

In his textbook on obstetrics Williams states that as far as may be determined, all cases of hydrocephalus have their origin in early embryonic life, before the cranial cavity has been closed and are referable to the action of bacterial or other pathogenic forces. He explains the common clinical type as the result of injury originating in early embryonic life, the distended lateral ventricles remaining intact, the fetus often living to term, and the large accumulation of fluid causing dystocia.

WILLIAM J. MCALLISTER, K.S.C., '39.
Manhattan, Kans.

* * * *

Negri bodies were found in 37 of 44 dogs' heads examined at the University of Illinois in one month during 1938. The chances of finding negri bodies in the brain of a dog suffering from rabies are much increased by permitting the dog to live as long as it will. The brains of rabid animals killed early in an attack fail to reveal negri bodies in a considerable number of cases.

Dextrose Therapy*

By J. PAUL BISHOP, Argo, Illinois

THE value of dextrose in medicine was recognized long before anything was known of its properties. As early as the tenth century B. C., honey and fruit syrups were given to the young, particularly to weak children. Sweet food stuffs were considered easily digestible, assimilable and energizing, giving renewed vigor to persons with diminished digestive capacities. The prescription of honey and fruit syrups was continued by the Greeks and handed down to the Roman physicians. The administration of dextrose in the form of natural nutrients has continued throughout the ages, but not until the latter part of the 19th century, did its physiological rôle begin to assume a scientific basis.

The preparation of pure dextrose and the establishment of its first structural formula marked the beginning of a new era of carbohydrate chemistry and physiology. Emil Fischer was the first to give a scientific interpretation to the action of dextrose. Although our knowledge of its physiological action steadily increased from that time, it was not well understood until about 1912, when a method was discovered for the determination of blood sugar. Finally, the isolation and purification of the pancreatic hormone insulin in 1922 gave modern medicine a means of regulating the utilization of dextrose by the human body. These two events made possible precise studies of carbohydrate metabolism and the standardization of methods of dextrose therapy. Modern industrial chemistry has given the medical profession chemically pure dextrose, without which this extensive research could not have been pursued. Much progress has been achieved recently both theoretically and clinically, so that today dextrose therapy constitutes one of the safest and most valuable methods of treatment which physicians and surgeons have at their disposal.

■ Grape sugar is the oldest and perhaps the most expressive name used to designate dextrose. Dextrose was first separated from grape juice in a solid but impure form. The name glucose is derived from the Greek, as are most names of chemical compounds. The combination of *glukus*, meaning "sweet", and the suffix *ose*, denoting "carbohydrate," describes dextrose. The U. S. Pharmacopeia had defined glucose as "corn syrup", which is a mixture of dextrose, maltose and dextrines. This obviously is not the same substance as purified grape sugar which is a white, crystalline, pure monosaccharide with entirely different properties. Therefore, in 1926, in order to avoid confusion, the U. S. Pharmacopeia accepted "dextrose" as the term for chemically pure grape sugar. Today the name dextrose has completely replaced other names for this sugar throughout the world.

■ Dextrose was first obtained in pure form by a German chemist in the middle of the 17th century. It was extracted as such from grape juice. The first commercial method of preparation of dextrose was introduced in 1811 by hydrolyzing starch ($C_6H_{10}O_5$) with dilute acid, which is the basis of our present plant-scale production. Dextrose crystallizes into the hydrate form as small white needles, and has the chemical formula $C_6H_{12}O_6H_2O$. The acid used does not enter into the reaction, but is only a catalyst.

Dextrose is made commercially today in three forms: the hydrate previously described, *alpha* anhydrous dextrose and *beta* anhydrous dextrose. The chemical formulæ for the two anhydrous forms are identical, except that the structure is reversed, so that the molecules are superimposable upon each other. The principal difference in these two products is in their rate of solubility, the *beta* form being much more readily soluble than the *alpha* form. The chemically pure product is made by dissolving

*Presented before the Chicago Veterinary Medical Association February 14, 1939.

the anhydrous dextrose in pure distilled water and recrystallizing. This removes the small amount of impurities originally present, since these impurities are removed with the water. The specifications for c.p. dextrose, which is always used in the preparation of dextrose solutions, are as follows:

Ash: not more than 0.1 of 1%
Not more than a trace of combined heavy metals

■ The presence of dextrose in the blood stream was first detected in 1775, but it was not indicated as such until the middle of the 19th century. The first important investigations on the physiological actions of dextrose were undertaken in France where it was discovered that dextrose was present in all parts of the normal circulating body of man and animals.

Dextrose, the primary substance of carbohydrate metabolism is supplied to the body mainly in the form of sugars and starchy foods. All carbohydrates must be broken down into monosaccharides by the digestive organs before they can be absorbed into the blood stream. During digestion, starch is hydrolized to its constituent parts by the digestive enzymes. Sucrose is broken down into one molecule of dextrose and one molecule of fructose; lactose, or milk sugar, into one molecule of dextrose and one molecule of galactose. Dextrose thus constitutes by far the greatest proportion of the monosaccharides absorbed into the blood stream and obviously, when dextrose itself is ingested, it is absorbed from the alimentary tract without requiring previous digestion. The absorption of dextrose from the alimentary tract is rapid and takes place mainly in the small intestine, being comparatively negligible in the stomach and colon. The relative absorption rates of the common monosaccharides are:

Galactose	110 milligrams per hour
Dextrose	100 milligrams per hour
Fructose	43 milligrams per hour
Mannose	19 milligrams per hour

This ratio exists for intestinal absorptions in animals as well as in the human body, although the absorption rates may vary in different species.

■ The actual mechanism of the absorption of dextrose into the blood stream is complex. Following the absorption, the monosaccharides are transported by the portal vein to the liver, through which they must pass before entering the systemic circulation. All these monosaccharides are converted into dextrose in the liver, probably through their intermediary stage of glycogen. The only sugar normally entering the systemic circulation for utilization by the tissues is dextrose. This, therefore, makes dextrose the primary substance of carbohydrate metabolism. Although it was formerly believed that the conversion of monosaccharides to dextrose took place during the absorption, there is at present sufficient evidence of the accepted view that this process occurs in the liver. Glycogen is formed and stored mainly in the liver by the process of glycogenesis. This stored glycogen is the sole carbohydrate reserve of the animal body. Glycogen in the human and animal body is comparable to starch in the plant kingdom and manifests some of the characteristic reactions of starch. Glycogenesis, the conversion of dextrose into glycogen in the liver, is a reversible reaction. When the absorption of dextrose from the alimentary tract has ceased, or when the demand for dextrose by the tissues is greater than the immediate supply, the liver glycogen is reconverted into dextrose by the process of glycolysis. Dextrose so formed passes from the liver cells back into the blood stream for further distribution and utilization. Through the processes of glycogenesis and glycolysis, the liver acts as the main regulatory apparatus of the quantity of sugar in the blood.

Dextrose circulating in the blood stream after passage through the liver is taken up by the muscles for glycogen synthesis and subsequent oxidation. Dextrose is the only carbohydrate directly utilizable by the tissues in adequate quantities. It is therefore removed from the blood stream more rapidly than any other sugar. Muscle glycogen, in contrast to liver glycogen with which it is chemically identical, serves for local consumption only. The formation of glycogen

in the muscles may be considered as the first step preparatory to the ultimate combustion of dextrose for energy purposes.

■ Dextrose is burned by the human and animal body in preference to other fuels, including proteins and fats. It is the main source of body energy. It is the fuel with which Life's engine runs, and is therefore essential for normal life processes. Exothermic oxidation reactions involving dextrose always take place during muscular contraction, regardless of whether such contraction merely maintains a simple posture and respiration, or accompanies vigorous exercise.

The formation of lactic acid is an intermediate step in the formation of carbon dioxide and water as ultimate products of dextrose oxidation or utilization by the body. This was realized in early physiological studies.

The hepatic functions, glycogenesis and glycolysis, make the liver the main regulator of the blood sugar level. More precisely, the maintenance of the blood sugar level normally depends upon an equilibrium between the demand for dextrose by the tissues and the supply of dextrose liberated by the liver for this purpose. In normal metabolism, the dextrose supply meets the demand so that the percentage of sugar circulating in the blood is at a comparatively constant level.

■ Certain conditions modify the rates of glycolysis and dextrose utilization by the tissues. The result is an abnormal fluctuation of the blood sugar concentrations. Such changes may be temporary or chronic; produced pathologically or experimentally. They are normally attributed either to nervous stimulation or to the presence or absence in the body of an exciting agent, such as the hormone insulin. Nervous stimulation may not only act directly upon the liver to accelerate glycolysis, but may affect also the hormones, particularly insulin and adrenalin, which in turn influence carbohydrate metabolism. The study of the physiological action of the hormones in relation to carbohydrate metabolism is therefore important for a more complete understanding of the regulation of dextrose concentration in the blood. The internal secretion of the pancreas, insulin, is the hormone exerting the greatest influence on carbohydrate metabolism. The animal organism is unable to utilize dextrose without insulin. The relationship between pancreatic function and carbohydrate metabolism was first demonstrated in 1889. It was observed that in depancreatized dogs a continued hypoglycemia was present, comparable to diabetes mellitus in man.

Insulin production in the normal body and blood sugar levels are interdependent. The cells of the islands of Langerhans of the pancreas are sensitive to the concentration of the blood sugar. Their activity is stimulated by the presence of even a very slight excess of dextrose in the blood. As a result more insulin is produced in order to mobilize the excess dextrose, which is then promptly removed from the blood stream.

Thus the administration of dextrose stimulates insulin production so that a prolonged state of hypoglycemia and glycosuria is not obtained in the normal body. Insulin itself is, therefore, an important regulator of blood sugar, and consequently of carbohydrate metabolism. If for some reason excessive amounts of insulin are produced in the body, too much dextrose will be mobilized and removed from the blood stream.

Another hormone important in the regulation of the blood sugar is that produced in the adrenal glands, epinephrine, also known as adrenalin. Chemically it is a derivative of benzene, containing an amino-acid group. The physiological action of epinephrine is antagonistic to that of insulin.

The main source of glycogen in the liver is derived from carbohydrate foods; nevertheless, non-carbohydrate substances may be utilized by the normal body. About 10% of the fat foods ingested yield glycerol upon saponification. Glycerol undergoes oxidation and subsequent condensation to glycogen through an intermediary stage of dextrose.

Protein likewise is converted to glycogen and dextrose in the liver. It has been shown

that up to 58% of the protein food ingested is ultimately transformed into dextrose through the intermediary of amino acid.

■ Dextrose may be administered orally, rectally or by injection; it is completely absorbed by the blood, regardless of its mode of administration. However, it is best given orally when possible because of the ease of administration and great tolerance of the alimentary tract. Dextrose stimulates secretion of gastric juices, yet does not strain the stomach or intestines because it requires no digestion. None of the dextrose ingested is ever lost in the feces. Dextrose is readily absorbed and assimilated, and supplies quick energy to the body. It does not disturb the appetite.

The value of rectal administration of dextrose is controversial. It has been found, however, that sufficient absorption of dextrose takes place *via* the rectum to justify its clinical use, when such a method of administration is indicated.

Dextrose is one of the few nutrients which may be introduced directly into the blood stream. Reactions such as chill, fever and other manifestations of shock may occur if the dextrose solution is not carefully prepared. It is essential that the ingredients of the solution be of the highest purity; chemically pure anhydrous dextrose fulfills this condition and is available at reasonable cost. The water used should be doubly distilled and sterilized.

■ The most common therapeutic use of dextrose is in the treatment of alimentary diseases. Vomiting releases gastric secretions containing mainly water and hydrochloric acid normally present in the stomach. The loss of acid obviously leaves an excess of basic salts in the body, producing alkalosis. The water lost during vomiting is drawn from the blood stream. Severe vomiting results not only in alkalosis, dehydration, and metabolic disturbances, but in a state of starvation. The liver is then called upon to supply the carbohydrate necessary for metabolism. Dextrose solution serves admirably to alleviate the symptoms of both mild and severe vomiting, as the treatment of vomiting must primarily combat alkalosis and dehydration.

Another condition for which dextrose therapy is indicated is diarrhea. The excess water which is eliminated is drawn from the tissues and is accompanied by a corresponding loss of basic salts. (This is the opposite of the situation found in vomiting.) As diarrhea progresses, it brings on both dehydration and acidosis. Treatment therefore must provide for the replenishment of the body with fluid and for the restoration of the acid-base equilibrium. Both ends are attained by the oral or intravenous administration of dextrose solution; the water supplies the fluid, and the diuretic properties of dextrose lead to excretion of excess acid, and to subsequent restoration of the normal acid-base equilibrium.

In skin diseases, the amino-acid content of the blood and the ammonia content of the urine rise. It has been proved that the blood sugar is abnormally low in the case of eczema and other skin troubles. The liver is gradually drained of its glycogen content and the blood sugar level is gradually reduced. Dextrose is thus indicated, as it serves to restock the liver and increase the blood sugar to its normal value.

All surgical operations involve liver depletion to some extent. Starvation during illness and anesthetic drain the glycogen supply from the liver. The consequences may be serious, especially if the resistance of the patient has been lowered by disease previous to operation. Dehydration and hemorrhage both result in a diminished blood volume and decreased blood viscosity, also lowering of the normal blood sugar. The injection of dextrose in normal salt solutions is indicated for both pre- and post-operative treatment.

■ It has been discovered recently that the daily oral administration of one to two pounds of dextrose to milk cows during pregnancy and the first month after parturition is insurance against acetonemia. Ketosis or lambing paralysis in ewes also can be prevented by including dextrose in the ration the last 8 or 10 weeks of pregnancy.

Technique of Physical Examination

WHEN the owner of a dog or cat presents his animal for an examination and diagnosis, he expects to see the strictest asepsis practiced in every procedure. Perhaps there was a time when a veterinarian could get along without giving much attention to the simple rules of cleanliness. But today it is necessary to take every precaution or one is liable to criticism from the well-informed clientele of the present time.

It is quite essential to give considerable thought to the arrangement of the hospital quarters. A waiting room, office, examining room, infectious and non-infectious disease wards, and pharmacy are necessary. The extent of such arrangement depends upon the amount of small animal work that is done. However, to obtain a complete history of any clinical case, it should be possible to talk with the client in a private office, else in many instances points of importance are held back, perhaps because of embarrassment in the presence of others.

The dress of the clinician cannot be overlooked. He must appear neat. He should wear such equipment as rubber apron and rubber gloves at all times in order that precautions may be taken in handling both infectious and non-infectious cases.

■ When a case is presented a complete history is essential. This includes a record of previous ailments, the owner's description of the present condition as to symptoms, length of time involved, diet, and a complete record of any medication that may have been given. Keep always in mind when taking a case history the possibility of rabies. With this condition so prevalent in certain sections at this time, it might be well to consider each case a potential rabies suspect.

When the possibility of rabies has been eliminated, observe the animal generally. Note the facial expression. Is the animal bright and alert, or is it dull? Toxic conditions, often reflected in the facial expression, may require a great deal of further examination. If possible, it is advisable to have the animal walk to the examining room, observing it meanwhile for any peculiarities of gait, evidence of stiffness, arched back, and the like. These symptoms may

"Keep always in mind the possibility of rabies."

well indicate any one of the following: rheumatism, luxation of patellæ, intoxication as a result of a severe enteritis, or other systemic conditions.

At this point the animal should be placed on the examining table and the examination proper begun. The temperature, pulse, and respiration should be taken. It is unnecessary to explain their importance in making a physical examination.

■ Next make an examination for intestinal parasites. Perhaps there will be sufficient fecal material on the thermometer for an examination by the flotation method. If not, insert a fecal loop and obtain sufficient material to make at least a reasonably satisfactory examination. It is preferable to have the owner present an entire evacuation for such an examination. This examination includes the mixing of fecal material with a saturated salt solution or

in Small Animals

By J. H. KNAPP, Columbus, Ohio,
College of Veterinary Medicine,
The Ohio State University

a sugar solution and allowing it to stand three to five minutes with a slide inverted over the container.

It is not always possible to make a positive diagnosis on the first examination of the feces. Frequently a series of examinations is necessary. In clinical cases presenting such symptoms as poor physical condition, pale mucous membranes, intermittent diarrhea and constipation, with perhaps free blood in the evacuations, a series of examinations should be made. In many cases a gross examination of the fresh feces aids in making the diagnosis. Tapeworm, Ancylostoma, and whipworms are definitely difficult to diagnose on the original examination. In cases where a tapeworm infestation is seriously suspected, as when the animal is or has been heavily infested with fleas, or where dogs have been allowed to eat rabbits, then the following examinations should be made:

1. Examine the gross fecal sample for tapeworm segments.

2. Examine the hair on posterior surfaces of legs or just below anus for the small brown, dried segments which frequently adhere closely to the hair.

3. When the anal glands are seemingly filled, express the contents of the glands carefully and observe the exudate. Frequently tapeworm segments may be found mixed with the expressed material. Whether these tapeworm segments are removed from the most posterior bowel or actually expressed from the anal glands is a question.

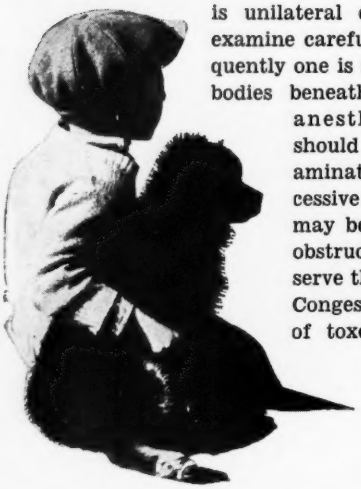
If a tapeworm segment be found by any of the above methods, it should be broken open and examined microscopically in order to determine the origin of the infestation. The flea is the intermediate host of *Dipylidium caninum;* the rabbit of *Tænia pisiformis.*

Even though a positive diagnosis of tapeworm be not made, treatment may be warranted if the owner can adequately describe the tapeworm segments that he has seen passed by the animal. As a general rule, however, it is not only wise, but essential to satisfactory treatment, that a definite diagnosis be made before treatment is commenced.

■ When the intestinal examination is complete, proceed with an examination for external parasites. Examine carefully for evidence of lice, fleas, or ticks. Lice, even when the infestation is light, produce a severe dermatitis and lead to such unrest of the animal that there is loss of weight. Fleas irritate the skin of the dog or cat constantly, and are an important factor in tapeworm infestation as they serve as an intermediate host of *Dipylidium caninum.* Ticks, though not so commonly observed as lice or fleas, nevertheless cause considerable trouble in some sections of the country during the warmer parts of the year.

■ After completing the examination for external parasites other than mange, note the condition of the skin and hair coat. In the case of toxemias, whether due to an intestinal disorder or to an ailment of any of the other vital structures, the hair coat often appears dull and lusterless. A deficient diet, parasitism, or bacterial infection may be the cause of such intoxications. A severe enteritis and the resulting toxemia may produce a dehydration so severe that the skin appears lifeless.

A principal requisite of successful small-animal practice is ability to examine the animals thoroughly and competently. Here is an article dealing with this important phase of the veterinarian's work. Doctor Knapp tells what to look for, and how to look for it, with several useful suggestions as to necessary equipment, as well as proper techniques.



An examination of the skin and hair coat should include the examinations necessary to detect mange, ringworm, or dermatitis. Diseases of the skin are so complex that it is not possible to discuss all of them at this time. The non-contagious skin conditions affecting the dog and cat generally include eczema, dermatitis, and acne, dermatitis and eczema being frequently used interchangeably. The causes include: parasitism, dietary deficiencies, lack of exercise, over-feeding, protein sensitization, external parasites, and too frequent bathing, or the accumulation of filth and moisture in the coat of long-haired breeds. Contagious conditions involving the skin include mange, both demodetic and sarcoptic, and ringworm. In the case of sarcoptic mange the skin often appears dry and scaly, the body may be almost devoid of hair, and an almost constant scratching is noted. The lesions commonly involve the forehead, ears, and forelegs. To make a differential diagnosis a microscopic examination is necessary. In many cases numerous examinations are required to find the sarcoptic mite. It is usually quite easy to demonstrate the demodetic mange mite, especially when the scraping is taken from an untreated area. The scraping should be made deep enough in the case of the demodetic type of mange to cause slight capillary hemorrhage. The ringworm lesion may be diagnosed by the characteristic circumscribed, raised area, though such diagnosis should always be substantiated by finding the fungus *Herpes tonsurans* under the microscope.

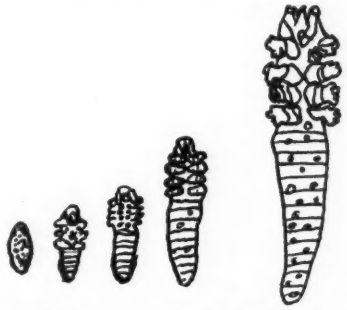
■ The general examination of the eye is easily accomplished in ordinary daylight. Inspect it for any evidence of excessive lacrymation. Note whether the lacrymation is unilateral or bilateral. If unilateral, examine carefully for foreign bodies. Frequently one is able to locate small foreign bodies beneath the third eyelid. Local anesthesia, codrenin perhaps, should be used for a complete examination. In some cases an excessive unilateral lacrymation may be due to conjunctivitis and obstruction to the tear duct. Observe the color of the conjunctivæ. Congestion is often noted in cases of toxemias, while a local conjunctivitis may be due to specific injury, irritant, or bacterial infection. A purulent conjunctivitis is commonly observed in conjunction with distemper or other infectious or contagious diseases, or as a secondary factor resulting from a lowered resistance of the tissues. In such cases the discharge is bilateral. In some instances, bacteriological examination should be made for staphylococci or streptococci, either hemolytic or non-hemolytic. These examinations are often of definite assistance in making a prognosis as well as a diagnosis.

A pale color of the conjunctivæ may indicate an anemic condition due perhaps to parasitism or possibly to internal hemorrhage. An icteric or yellowish discoloration is indicative of the absorption of bile. Observe the conjunctivæ carefully for evidence of tumors. As one proceeds with the examination note the position of the eyelids. Do they turn in or droop outwardly? Is the condition unilateral or bilateral? An entropion may be the result of wounds or of an inherited tendency, as in the chow. Entropion may cause opacities or ulcers of the cornea or a chronic conjunctivitis. Note the position of the lids, as this often bears an important relation to certain types of paralyses of the facial nerve, or to chorea, an aftermath of distemper. Note whether any tumors are present, as they often cause various degrees of inflammation of the eye structures, or, if they become large enough, may gradually overcome the muscular action and drag the eyelid downward.

Next examine the pupils. Note the reaction to light. Are dilation and contractibility normal? An extreme dilation of the pupils is often observed in such infectious diseases as rabies and in some cases of distemper. In certain instances a chronic dilation of the pupils and a consequent loss of sight are observed as an aftermath of distemper.

After thoroughly examining the eyelids, conjunctivæ, and pupil, proceed with the gross examination of the cornea, noting the presence of ulcers and opacities. Note the membrane nictitans. The cornea is normally transparent, forming the anterior covering of the eyeball, and is spherical in shape. The ophthalmoscope is essential in making this examination. Good light is necessary. The use of artificial light may assist in comparing the size of the cornea. The cornea is quite sensitive and should react readily to the touch. Examine the cornea for smoothness. Eliminate the possibility of ulcers. Ulcers may be the result of a keratitis, or of distemper, or of infection which has spread from a purulent conjunctivitis, or of mechanical irritants, wounds, or foreign bodies. Perhaps only a scar remains, the result of a past corneal ulcer. Examine for opacities of the cornea, which may vary from a slight turbidity to a milk-white film covering the entire cornea. Opacities may be attributed to wounds or mechanical irritants, or perhaps to malnutrition, particularly vitamin A deficiency; or they may be present as an aftermath of distemper or some other general constitutional disease. Lastly, the animal should be taken into a dark room for a more thorough examination of the deeper structures of the eye with the ophthalmoscope. The use of local or general anesthesia is sometimes necessary.

■ The external ear of dogs varies greatly in size, depending upon the breed and size of the animal. The ear is easily examined by direct inspection. A careful examination should be made for wounds, foreign bodies, and hematomas. Hematomas, though usually the result of injuries, may be a result of shaking the head from severe otitis, frequently parasitic in origin. This parasitic condition is best examined with the otoscope. The parasites may be demonstrated, microscopically, in the débris found in the ear. Parasitic otitis is more common in the long-eared breeds, such as the cocker spaniel, than in others. It is quite frequently observed in cats. The otoscope is needed not only for the diagnosis but to observe the progress made in treating such cases. When there is a history from birth of failure to bark, or to respond to commands, one may suspect a congenital deafness, but should eliminate the possibility of any chronic inflammatory process before making such a statement. In instances where ordinary treatment is hopeless, and parasites have been eliminated, bacteriological examinations should be thought of with a view to developing an autogenous vaccine. Though it may not be important from the standpoint of health, it is well that the veterinarian should observe the symmetry of the ears, and their carriage, and be able to advise if cosmetic treatment is indicated.



The demodetic mange mite is easily detected on microscopic examination. Here are five stages of *Demodex folliculorum*, from egg to mature "grub."

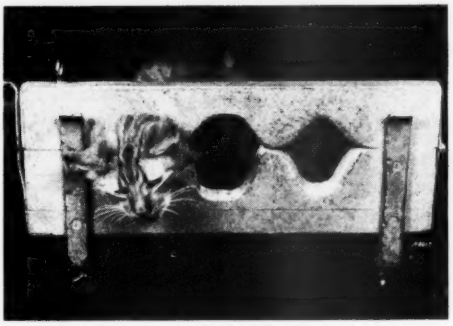
■ In making an examination of the nasal passages, we must consider the breed of dog, having in mind, for instance, the normal snoring sounds produced by bulldogs, due to the short and tortuous air passages. The character of the discharge from the nostrils must be given definite consideration. The nose in health is generally moist and cool, with a thin, slightly serous discharge. A serous discharge, followed by a

mucopurulent one and then by one of a hemorrhagic type, in conjunction with such symptoms as sneezing, or an extremely nervous temperament, may lead one to suspect *Linguatula rhinaria*. In such cases microscopic examination is essential. The nasal passages should be examined carefully for evidence of previous injury, or the presence of foreign bodies which may be deeply imbedded and possibly a source of chronic rhinitis. A local condition, an acute or perhaps chronic nasal catarrh, may produce only a serous discharge from the passages. In some cases a severe sneezing is produced as well as a purulent discharge, plus a great many general symptoms such as those often encountered in chronic absorptive conditions. The most common type of discharge noted, however, is that infectious type seen in conjunction with distemper. These discharges may vary from a serous to purulent or hemorrhagic. They are quite easily distinguished from the others frequently seen. One should observe the nasal bones carefully for any evidence of deformities which may have resulted from rachitis, alveolar periostitis, or injuries, and which may interfere with the free passage of air. One should not, of course, forget the possibility of tumors or polyp enlargements which may occur within the nasal passages. These latter conditions are more likely to be unilateral than bilateral.

■ One is often able to obtain a general index as to the animal's condition by thoroughly examining the mucous membranes and teeth. Note that the collection of tartar is often responsible for a gingivitis and perhaps in time an alveolar periostitis. An ulcerative stomatitis often accompanies the chronic accumulation of tartar. In examining the teeth, observe carefully for malformations. Note any injuries, since in time dental injuries may lead to alveolar periostitis, and terminate in dental fistulæ. In examining the oral cavity one must be ever mindful of the possibility of rabies, as well as of the possible presence of foreign bodies. Note the color of the mucous membranes. An extreme paleness may indicate parasitism, internal injuries, or perhaps dietary deficiencies. A yellowish discoloration of the visible mucous membranes may lead one to suspect a varying degree of enteritis and the resulting obstruction of the bile duct. While the mouth is being held open by use of tapes or speculum, examine the larynx and tonsils. With proper light the larynx can be examined easily. Laryngitis may be either acute or chronic. The symptoms may vary from a slight periodic cough to an almost continuous or spasmodic cough. The cause may be excessive barking, exposure to cold, extension of inflammatory conditions from adjacent parts, or the cough may be secondary to infectious diseases, such as rabies and distemper. Note also the condition of the tonsils. Tonsillitis not infrequently causes a chronic cough, as well as being a possible source of such a degree of absorption as to lead to numerous generalized symptoms. If focal infection is suspected a bacteriological examination of the tonsillar tissues is advisable. Such infections have been found to be both streptococcic and staphylococcic.

■ If the animal has remained in the recumbent position, allow him to rise and then begin an examination of the abdominal organs by palpation. Observe closely any evidence of umbilical or inguinal hernia, or of an extra large inguinal ring which may result in a tendency to hernia. Palpate the animal gently over the abdominal region. Note the degree of distention, sensitivity, and tenseness. Such an examination may lead one to suspect one of the following: parasitism, particularly ascariasis in young animals, gaseous distention of the stomach, or intestines, or possibly ascites, as seen more commonly in older animals. Naturally if these conditions are suspected then further specific examinations, such as fecal examinations, paracentesis, etc., should be performed. Determine whether the animal is constipated and palpate for enlargement involving the posterior intestinal tract. The uterus can usually be palpated, when the history is suggestive of uterine infections, and considerable information so obtained. One may

palpate the kidneys to determine any enlargement, misplacement, or possible injury. In the case of cirrhosis of the liver or an acute inflammatory condition, the liver can be quite distinctly palpated through the abdominal wall. Such symptoms as a chronic intestinal disturbance, perhaps icteric discoloration of mucous membranes, possibly ascites, may be symptoms that would indicate to some degree cirrhosis of the liver. When the history is such that one is led to suspect an intussusception of any portion of the intestinal



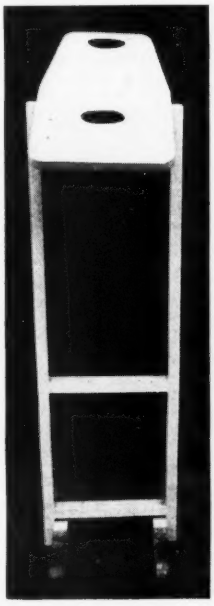
Cat stocks such as these used by Dr. Chas. Stewart, are worthwhile for the restraint of cats.

tract or uterus, such an enlargement may be palpated through the abdominal wall.

Naturally we include in the physical examination a search for so-called beady formations of the costochondral junctions as probable evidence of rachitis.

■ In the examination of the external genitalia, we should include the examination of the scrotum, penis, and sheath of the male, the vulva and vagina of the female. Though a certain degree of balanitis may be considered almost normal for the male dog, any undue chronic discharges are significant. Foreign bodies are commonly found imbedded into the innermost tissues of the sheath. Chronic purulent or hemorrhagic discharge, with possible ulceration of the penis, may well indicate a bacteriological examination. In the female sufficient examination should be made to differentiate estrum from metritis and to detect vaginal tumors, common in aged females.

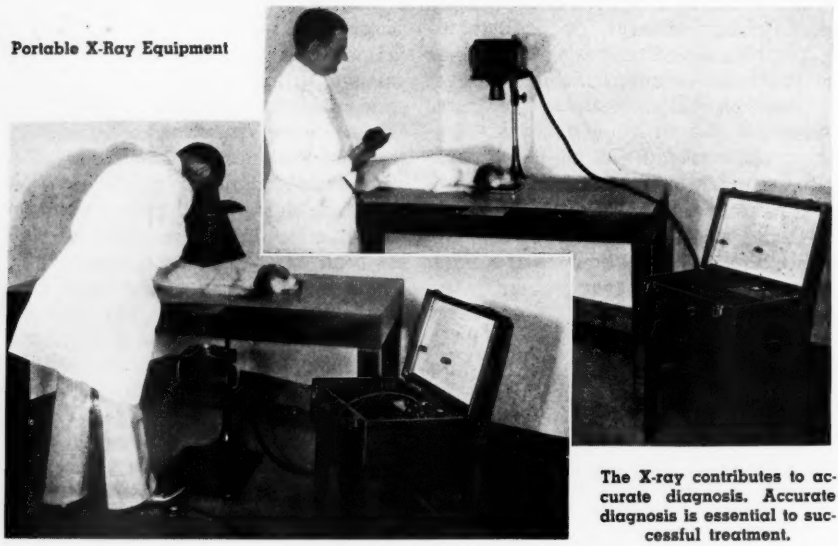
Though considerably more attention has been given the prostate glands within the last few years than previously, it is an established opinion that diseases of the prostate gland are of much greater importance as regards the health and longevity of male dogs than most veterinarians suspect. Disease of the prostate gland in lower animals is almost entirely restricted to the dog. The prostate gland surrounds the neck of the bladder and urethra at their junction. The average weight of the prostate, according to Schlotthauer, is approximately 0.4gm of prostate for each kilogram of body weight. Schlotthauer further states that after the age of five years, this relationship varies markedly. One can readily gain some knowledge of the prostate gland by rectal examination; some feel that it is possible to examine the prostate gland quite thoroughly by careful palpation through the abdominal wall. What is the importance of examining the prostate gland of the dog? A hypertrophy of the gland may produce sufficient pressure to cause a retention of urine, and indirectly an intoxication that if not relieved may



RESTRAINT FOR CATS

This table constructed of wood and carefully enameled makes an attractive and efficient appliance for the restraint of cats for examination, treatment and for many operations. The table can be rotated into any position from horizontal to prependicular with either end up. It is held in any desired position by friction. The whole appliance weighs but 10 pounds. The animal's legs are placed through the slots in the table and held beneath by an assistant.

Portable X-Ray Equipment



The X-ray contributes to accurate diagnosis. Accurate diagnosis is essential to successful treatment.

produce death. Such symptoms as an arched back, stiff, stilted gait, frequent attempts at urination, evidence of pain when attempting to urinate or to defecate, are commonly produced by an acute prostatitis. Because of the pain associated with defecation, constipation is frequently observed. In addition to the simple hypertrophy of the gland a cystic degeneration or abscessation may be observed.

■ Foreign bodies are not uncommonly recovered from the posterior bowel. When a severe inflammatory condition is noted and perhaps free blood is being passed from the most posterior portion of the intestinal tract, accompanied by extreme pain, one should carefully search for and eliminate the possibility of foreign bodies. Particularly is this true of young animals, as they are more apt to swallow such materials as would cause damage.

■ It is not necessary to discuss the importance of the x-ray in the diagnostic procedures of fractures, location and removal of foreign bodies from all portions of the body, and less commonly perhaps, but effectually, its use in the diagnosis of certain types of hernia, such as diaphragmatic and femoral. Though the original cost may be somewhat large, the practitioner will find that the x-ray is indeed an asset when used judiciously for diagnostic purposes and, less commonly, as a therapeutic agent.

■ Though the routine examination of the blood has not yet become a general procedure in making an original physical examination, in many instances blood-examinations are of extreme importance in arriving at a correct and conclusive diagnosis, as well as of great assistance in making a prognosis. For example, the laboratory examination of the blood for dirofilaria is a very important feature of a complete physical examination when a history of such symptoms as easy tiring, possibly a chronic cough, dermatitis, or a gradual loss of weight, is presented, particularly in a sporting dog. The examination of the urine may assist one in diagnosing such common conditions as nephritis, cystitis, chronic enteritis, or diabetes. In short, when one is at all in doubt, a clear laboratory picture of the blood and a urine analysis are definite aids to a conclusive diagnosis and assist generally in making a prognosis.

Chronic Fistula in a Dog

A 30-pound, four-year-old, male, shepherd dog was brought to Dr. H. R. Groome's small animal hospital, Twin Falls, Idaho, on July 16, 1938. He was walking on three legs; making no use of the left hind leg, upon which the hair was matted over the hip and showed evidence of a suppurating wound.

History.—The owner stated that the dog had sustained a simple fracture of the left femur when less than one year of age, and had been taken to a veterinarian who applied a modified Thomas splint to the limb with apparent success. The bone healed, but the dog failed to use the leg, and in a relatively short time a fistulous opening developed at the level of the acetabulum on the lateral aspect of the joint. The animal was returned for examination two or three times. Each time the tract was probed and examined, but nothing was found to indicate the cause of the discharge.

The owner informed us that the flies were becoming such a nuisance to the animal that he had decided to dispose of it if nothing could be done.

Examination.—The area around the opening was clipped and shaved to facilitate examination. The tract was probed carefully and found to extend deeply posterior to the femur and on downward and medially to the medial side of the stifle joint where the end of the probe was easily palpable. No foreign body was found, however. It was decided to give a general anesthetic and open the tract to admit a more extensive examination.

Treatment.—Four and one-half cubic centimeters of nembutal was given in the external saphenous vein. The entire area on both sides of the stifle, thigh, and hip was clipped and shaved. It was then thoroughly washed and disinfected with alcohol.

An incision about 1½ inches long was made over the end of the probe on the medial side of the stifle; extending through the skin, fascia, and muscle and was enlarged enough to admit the little finger which was used to probe the tract from the distal end. In this way the end of a loose piece of bone was found lying near the callus from the original break on the posterior side of the femur. A pair of forceps was introduced along side the finger, the bone grasped and extracted with considerable traction. It was found to be an almost complete section of the femur measuring 2 3/16 inches in length (see illustration).

The Sequestrum After Removal

A half-inch incision was made into the tract at the proximal end, and a gauze seton soaked in tincture of merthiolate was run through the tract and tied securely. The seton was changed every day for four days. The antiseptic was alternated every other day between tincture of merthiolate and tincture of zephiran. When the seton was removed the first day, a piece of bone ½" in length (see illustration) came out with it.

Termination. — The dog was dismissed from the hospital July 20th. At that time the upper lateral wound was practically closed, and the distal medial wound showed an abundance of healthy granulation tissue.

July 30th the owner reported that the proximal wound had closed and the distal wound was healing rapidly. The dog was already using the leg for support during urination. Again on November 7th the owner reported the leg to be healed, almost in constant use, and the atrophied muscles filling out rapidly.

Due to the fact that this animal had carried the leg at least three years and there was very extensive muscular atrophy as a consequence, the extent of recovery was far beyond expectations. The fistulous wound was expected to heal, but it seemed unlikely that the dog would regain the use of the leg.

D. E. Evans, K.S.C., '39.
Manhattan, Kans.

Canine Pediatrics

XI. Environmental Factors in Successful Artificial Feeding of Very Young Puppies*

By D. M. CAMPBELL, Chicago, Illinois

WHOLESOME living conditions are as essential for the proper growth and development of a puppy as they are to a human infant. An artificially-fed pup must depend upon intelligent care from its handlers as a substitute for the instinctive care it receives normally from its dam.

Borden research workers, during the course of the program in which they formulated a successful simulated bitch's milk, developed a handling technique which greatly facilitated the many tasks of caring for puppies and which contributed in a measure to the success of the feeding experiments by reducing to a minimum set-backs from non-nutritional causes.

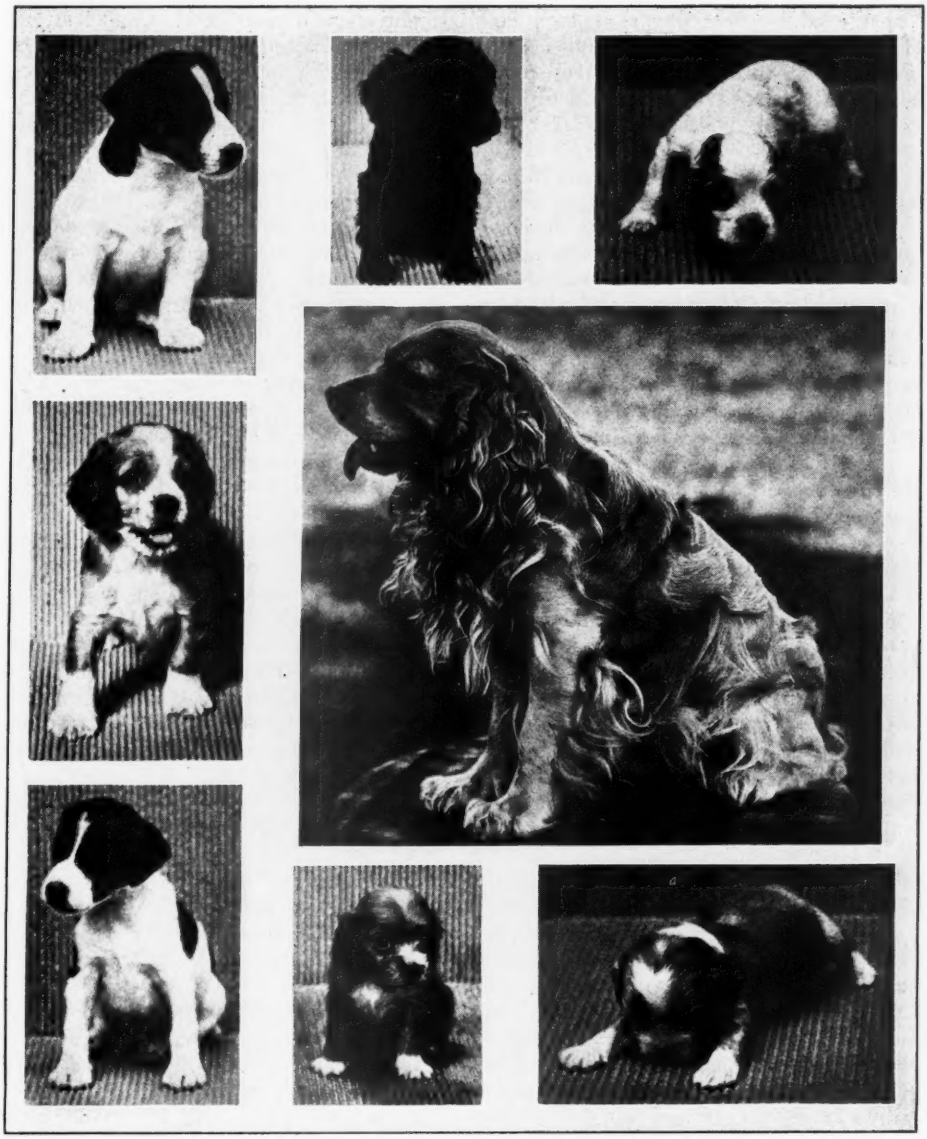
Procedures found useful in the experience of the research staff are summarized briefly in this article as practical suggestions to the veterinarian in the practice of canine pediatrics. Modifications or elaborations of these techniques may suggest themselves to the veterinarian in special circumstances.

First of these routine procedures falls somewhat within the realm of canine obstetrics—the care of puppies at birth if they are to be taken immediately from their mother. If it is necessary or desirable to remove the puppies immediately after parturition, all the pups should be left with the bitch until whelping is completed to prevent her from becoming unduly excited during the whelping period. Immediately after the puppies have been taken from the mother they should be wiped carefully and thoroughly with a clean dry cotton cloth. Care is advisable during this process to avoid rough treatment in the umbilical area to prevent hemorrhage from the cord. If the cord bleeds it should be treated with iodine to prevent infection.

Puppies must have proper housing and bedding. New-born puppies may be housed satisfactorily in corrugated cardboard boxes or cartons approximately 12 inches wide, 15 to 20 inches long and 9 inches or a foot deep. Several small holes should be cut in each side of the box to permit ventilation. A screen should be attached or weighted over the top of the box. No bedding other than a layer or two of soft, absorbent corrugated paper the size of the bottom of the box should be used for very young puppies because new-born pups frequently become entangled in rags, strips of paper, and similar loose material, and such entanglement may cut off the circulation. The corrugated paper should be thrown away and replaced with clean pieces whenever it becomes soiled as a result of urination or evacuation. Similarly the box itself can be discarded for a new one when it becomes wet or soiled.

Thoroughly healthy pups of very young age may be housed two together for warmth and companionship. Puppies that are ill or from which fecal observations are necessary, however, should be kept alone in a box to prevent mistaking the fecal material of one puppy for that of the other and to prevent possible infection. Even entirely normal and healthy puppies should be put alone into a box for sufficient time each day for observation of feces during the first three or four weeks to afford prompt recognition of abnormal stool conditions and the application of immediate therapeutic measures. Collection of the stools for observation is facilitated by the use of floor covers of clean white cotton cloth of suitable size, spread over the top and tucked under the edges of the corrugated

*Prepared in collaboration with Dr. G. C. Supplee and Mr. J. H. Le Ware, Borden Research Laboratories, Bainbridge, N. Y. This is the eleventh article of a series on nutrition in young puppies. The 12th and final installment of this discussion will appear in an early issue.



The photographs on this page show a representative group of puppies raised successfully on simulated bitch's milk in accordance with principles explained in the series of articles on canine pediatrics which have been appearing in VETERINARY MEDICINE since last June. The adult dog pictured in the center of the page is a cocker spaniel raised from birth on artificial feedings of the simulated bitch's milk. The dog, a healthy animal, 15 months old at the time the picture was taken, is owned by one of the scientific workers who directed the research program. The other pictures show puppies, mostly cocker spaniels, ranging in ages from 21 to 45 days, abruptly and gradually weaned or fed from birth on the formula. Cocker spaniels were selected for many of the feeding experiments because they were regarded as representing a mean between the very large hardy breeds and the smaller more delicate breeds.

paper in the bottom of the puppy's box. The cheapest grade of cheese cloth is satisfactory for this purpose. Floor covers should be changed twice daily and thoroughly washed, boiled and dried before using again.

After the puppies are a week or 10 days old—or by the time they have their eyes open—they may be removed from the boxes and housed, two together, in more permanent cages. A cage 20 inches square, fitted on four sides and the top with one-half-inch wire netting has proved quite satisfactory for the housing of two pups of average size. Usually it is difficult to keep the pen appropriately clean if more than two pups are kept together, but if there is an odd number in the litter it is preferable often to house three of the smaller puppies together rather than to leave one alone.

The bottom of the more permanent type of cage should be provided with a galvanized metal pan which may be cleaned readily. Cages should be cleaned thoroughly each day and the pans should be washed with a rag saturated with creosote solution. For puppies that have arrived at the age at which their eyes are open, shredded, absorbent paper or tissue paper makes excellent bedding. Straw is too harsh and irritating; wood shavings frequently cut the puppies and slivers may cause fatalities; sawdust often is swallowed and it tends to stick to the puppy and thus makes it difficult to keep the animal clean.

Five basic factors affecting the puppy's health and comfort are air temperature, radiation (as from stove or radiator), air movement, humidity, and light. The first four of these factors influence the normal balance between heat production and heat loss which maintains normal body temperature. Room temperature should be maintained at between 75 to 80 degrees for very young puppies. The boxes or cages should not be too near the stove or other source of heat. Puppies should be kept away from drafts, but the air should be kept moving adequately by means of an open window or circulating fan. Extremes of humidity should be avoided or corrected. Young puppies are at rest under comfortable air conditions and their total metabolism remains fairly constant, but the total heat loss may vary with any of the four factors just mentioned. During the night, in cold, damp weather, or if a puppy is ill, a hot water bottle may be used to increase the puppy's comfort. An ordinary mason jar, filled with water at approximately blood heat, with the lid tightly screwed on, makes a convenient hot water bottle. Frequently it is desirable to wrap the jar with clean cloth so that the puppy can climb onto it without slipping.

Very young puppies should have plenty of indirect sunlight. They should not be kept in a cellar or in a windowless room and as they get older they should be placed in such a position that they get direct sunlight whenever it is available through the windows.

Adequate and uninterrupted sleep and rest are essential to the proper development and health of the very young puppy. The 8-hour intervals between regular feedings are an essential part of the puppy's health regimen. When the pups are not eating they should be sleeping. After a few days on a properly-managed feeding schedule puppies will develop the habit of awakening automatically just before feeding time, just as an infant awakens and cries at each scheduled nursing or feeding period. Excitement, unusual noise or commotion, and visitors at irregular hours, who handle or tease the puppies, are definitely detrimental to the progress of the rapidly-growing animal, and usually cause the pups to cry and needlessly expend energy.

Constant supervision is necessary to assure proper hygienic conditions, as to both feeding and bodily condition of the puppy. It is appropriate to reiterate in this article that meticulous standards of cleanliness and sanitation should prevail in the preparation and feeding of the simulated bitch's milk and in the handling of all equipment used in connection with feeding. All utensils, bottles and nipples should be cleaned with the same degree of thoroughness that characterizes accepted practices in the kitchen of a modern home or restaurant. No residue nor encrustations should be permitted to

remain on any of the feeding equipment. All equipment should be cleaned immediately after use with liberal quantities of hot soapy water and with bottle brushes and nipple brushes. After the equipment is washed thoroughly all soap should be removed by thorough rinsing in clear hot water. Each item should be dried thoroughly. All food and feeding equipment should be kept in a suitable cabinet, box or cupboard to protect it from dust, flies, cockroaches, and other insects or pests.

The puppies themselves should be kept dry and clean. Artificially-raised puppies must be given artificial care to substitute for that the bitch normally gives her puppies wherein they are constantly licked dry and clean. Dry paper should be kept under the puppies at all times to prevent excoriations from ammoniacal urine. Should excoriations develop on the belly of a puppy as a result of urine exposure the area should be washed thoroughly, and oiled gently with plain vaseline or olive oil, and then dusted lightly with zinc stearate powder. If a diarrhea or diarrheic condition develops the buttocks should be washed with warm soapy water. Care should be exercised in all cases to use a non-irritating oil-base soap. After washing, the puppy should be dried thoroughly, oiled and dusted, in the manner just described. If the hair becomes matted it may be kept in proper condition by the use of a fine tooth comb.

Regular gentle massage is important in the daily health routine of the artificially-fed young puppy. This treatment is best administered just before feeding. Massage of the back and sides for a few minutes prior to feeding awakens the puppy thoroughly, stimulates the circulation and appetite, and, as a form of passive exercise, it stimulates the muscles and the skin and improves their tone and development. This treatment has the further psychological value of satisfying the puppy's instinctive desire for companionship and attention, and of making the animal responsive to human association at a very early age.

Puppies occasionally develop the undesirable habit of chewing or sucking their own toes, or if they are with another puppy, the toes, ears or genitals, of the second pup. The exact cause of this habit is a matter of speculation, but it is similar to the thumb-sucking or hand chewing habit of infants, and it may be a mis-directed manifestation of the suckling instinct, a teething reaction, or an infantile play effort. Whatever the cause, it frequently results in sores on, or infections of, the parts sucked or chewed, and usually may be cured by isolating the puppy exhibiting the habit. Many puppies do not form this habit, and those that do soon outgrow it.

Puppies' toe nails should be clipped often enough to prevent the pups from scratching themselves and each other and also to enable them to stand properly once they are able to get onto their feet.

The eyes of a very young puppy should be wiped every few days with a sterile cloth or with absorbent cotton dipped into a saturated solution of boric acid.

Puppies frequently are lice-infested, particularly if the bitch has not had proper care. If this condition is discovered immediate and proper delousing procedure should be undertaken.

Application of the hygienic principles recommended in this article fits well into the clinical practices suggested in a previous article, and with proper feeding schedule, establishes a practical and effective routine for the raising of puppies.

The baby pup's biological and environmental needs are similar to those of the human infant. It responds in terms of growth and health to care and devotion much as does the infant, and it suffers parallel physiological set-backs as a result of neglect. An artificially-fed puppy that has had the advantages of intelligent supervision should develop into a normally healthy young dog—and one whose intelligence level or canine personality is far above the usual standard of pups raised on the bitch.

The mental capacities of a puppy are not of direct concern in the science of nutrition, but the subject may well be touched upon here as a matter of particular interest to veterinarians and to dog breeders; it offers a possible field for further interesting

investigations in the science of comparative physiology.

Borden research workers charged with the care of some hundreds of puppies were impressed with the fact that the constant handling by humans in the daily feeding, cleaning, massaging, and weighing routine brought extraordinary response on the part of the artificially-raised puppies. The young animals became extremely gregarious and even at such early ages as five days eagerly welcomed the appearance of their human attendants and responded alertly to the sound of the human voice. This conditioning eliminated the shyness and signs of indifference to people that often are exhibited by puppies that have been cared for entirely by the bitch and therefore have not had the benefit of constant and extensive association with humans. The differences between the response of artificially raised puppies to the human voice and presence and that characteristic of pups as old as six to nine weeks raised by the bitch were so marked that the bottle-fed animals exhibited every indication of a definitely superior intelligence and the bitch-raised animals, appeared almost dull or stupid in contrast.

Since most puppies are raised for sale or for show purposes the remarkable development of personality and intelligence of artificially-fed puppies offers practical possibilities worthy of full exploration by dog breeders. Although the matter has not been put to a test with split litter controls the differing behavior of naturally and artificially fed dogs is such as to lead one to confidently expect that among hunting dogs the period of training for field performance can be much shortened and the expense materially lowered in the case of artificially reared puppies and that better final results would be attained by them.

Certainly, because of their greater friendliness toward humans, the bottle-fed puppies are potentially more companionable, and as pets, especially for children, more gentle. Present owners of some of the puppies that have grown to adulthood after starting their life on a bottle of simulated bitch's milk in the research laboratories report that the animals were more readily trained and house-broken than other pups.

The early conditioning of the artificially-fed puppy to react to the stimulus of the human voice and human associations, and the adaptation to regimented feeding and living habits could readily be accompanied by early training for show and sporting purposes, to the great improvement of their usefulness, and their saleability.

The discussion of the artificial feeding of young puppies in this series on canine pediatrics reaches its conclusion with this article. A review and summary is appropriate at this point to survey the broad foundation that has been established for the practice of canine pediatrics by the veterinarian, and to estimate the potentialities for the future. Basically, a science of canine pediatrics predicates a substitution of scientifically-planned and controlled care and

feeding of puppies from the time of birth or soon thereafter for the more casual and uncontrolled instinctive care and feeding provided by the bitch.

Since growth of the very young is fundamentally a problem of nutrition, canine pediatrics becomes primarily a program of artificial feeding of puppies. Any discussion of the relative merits of suckling of puppies at the bitch under optimal natural conditions and of artificial feeding on simulated bitch's milk under optimal controlled conditions woud be purely academic and almost certainly should terminate in favor of optimum suckling. It is difficult to excel Nature at her best. The urgent need for a working system of canine pediatrics, however, lies in the increasing departure, under existing practical conditions, of actual suckling capacities of an increasing number of bitches from the natural ideal, as discussed in the opening article of the series. How this need has been met through application to the canine species of the vast body of existing data on nutritional principles applicable to all species, and how these broad general principles have been particularized by clinical feeding tests on a large number of puppies, has been described.

From the broad abstract, theoretical and technical aspects of canine pediatrics, the articles have progressed to detailed analytical and qualitative studies of the various individual components of foods, particularly milks, and specifically natural and simulated bitch's milk. The very young puppy's requirements for, and capacities to utilize proteins, fats, carbohydrates, minerals and vitamins, in various ratios and balances have been considered in detail. On the basis of these data a highly satisfactory food for the artificial feeding of puppies is formulated. The question of how much and how often to feed is answered in a proved feeding regimen based on determined optimum fluid and caloric intake levels for puppies of different body weights and at different stages of nutritional progress. Abrupt and gradual weaning methods and introduction of solid foods are explained. Means of determining satisfactory progress and of detecting nutritional or physiological upsets, and procedures for correcting abnormal conditions through dietary control are incorporated in a diagnostic and clinical routine. Important incidental practices relating to the practical and hygienic care of artificially-raised puppies are suggested in this final article, and the end-result of the entire method of puppy raising is described—adult dogs equal in physical condition and superior in intelligence and responsiveness to dogs successfully raised on natural bitch's milk.

With a suitable basic simulated bitch's milk formula and with a sound program of feeding management for the successful artificial feeding of very young puppies available, the future of canine pediatrics lies in the hands of the practicing veterinarian who will be called upon to interpret the results of research, who will have to combat some misconceptions, and who have to nurture and propagate many of the basic concepts of applied canine pediatrics until the scepticism and inertia of the uninformed have been dispersed. Meanwhile, an increasing number of veterinarians and dog breeders are confirming in practical feeding of puppies the validity of the results of the laboratory and clinical research program. Canine pediatrics is gaining a momentum that promises to establish this youngest branch of veterinary science among the foremost aspects of veterinary practice in the small animal field.

This bitch whelped (*via* cesarean) 19 pups.

Abstracts

Leptospirosis in Dogs

Four types of leptospirosis may be distinguished. Mixed forms may also be observed.[31] The acute and peracute types are the most common forms observed clinically; they are characterized by icterus. Histologically, a severe destruction of the lobules of the liver may be seen. The gastrointestinal tract exhibits hemorrhages almost constantly. The ulcerative stomatitis, typical of Stuttgart canine disease, is not always present. In the subacute cases, without icterus, greenish lesions about the circulatory tract and the serous membranes are quite frequent. In the chronic cases, calcification is always present. The lesions then cease to be greenish, and appear to be white and sand-like.

Scenting Capacity of the Dog

Dogs are animals guided principally by scent.[32] The acuteness of their sight is considerably less than that of man, yet the possibilities of their capacity of smelling is beyond our comprehension. To the dog's nose the scent on the ground possesses the same significance as the guide posts on roads to our eyes. All hunting dogs are capable of scenting their prey. This does not preclude the dogs in the chase from making use also of their senses of sight and hearing.

It was formerly believed that the dog traces the footprint of his master on the basis ot the latter's individual scent. He was supposed to follow the particles of smell which the footprint left behind in form of exudation or particles of the skin excretions. In short, the process of scent was not considered to be a problem to the dog. In reality the process of scenting is very complicated as experiments have shown.

The first result of experiments was this: Every scent left by man or animal possesses a mixed odor. The latter is brought about by the fact that the weight of our bodies causes change in the soil. One can easily convince oneself that the field of scent from the impacted soil is more intensive than the field of scent from the soil which has not been impacted. The reason for this is seen in the greater evaporation of the impacted particles of the soil, having forced the humidity to the surface, and in part due to the injury to various plants stepped upon, the saps of which vary in quality and quantity of odor. Other factors are the change in odor within a few hours, brought about by the chemical reaction and fermentation processes induced by soil bacteria and fungi. To this must be added the odor from crushed small animal life. Many of these odors, including the odor of various soil formations (loam, sand, humus) attach themselves to our shoes and change the scent. By means of our shoes we even transmit the odor of leather and shoe polish to the soil. Finally, the footprint will also carry specific and individual human odors. Thus the dog is confronted with an odor complex, a real problem for the dog trainer and the dog.

The main question is now: Is the individual human scent the guiding principle in the dog's search or no? The answer to this is that by nature the dog is not capable of performing this feat, but that he can be trained to read the individuality of the scent.

Lambing paralysis or pregnancy disease of ewes can be diagnosed readily by testing the blood for ketones; that is by the Hayden test for acetonemia.

The diagnosis of scurvy was based on examination of the gums for ulcerative gingivitis and loosening of the teeth and on a tendency to hemorrhage and purpura. The latter is present in the pre-scorbutic stage and is difficult to distinguish from hog cholera, in which the gums are not abnormal. Hemorrhagic diathesis is an important diagnostic point in scurvy.—*G. Hartmann*

---

[31] Huguenin, B. and E. Bourgois. Canine Leptospirosis. (Transl. title). *Deutsche Tierärztl. Wchnschr.* 44:483-485.
[32] Schmid, B. The Dog's Capacity for Tracing Scent. (Transl. title). *Tierärztl. Rundschau* 42:689-692.

Retention Cysts of the Salivary Glands

The principal symptom of a retention cyst is the gradual swelling of the salivary gland.[33] The location of the swelling varies, depending upon the location of the duct involved. The classical form of the retention cyst is the ranula; it is found usually laterally from the frenulum linguæ. In the case of a cervical cyst the swelling is noticed in the intermaxillary space; occasionally the swelling may be found in the parotid region. Treatment consists in extirpation of the gland and drainage of the cyst. According to Pommer, Roentgen ray treatment is also useful in relieving this condition.

Noma in Dogs

Noma often follows in the wake of canine distemper. Almost always it terminates fatally because of complication with pneumonia and cachexia. Gratzl[34] obtained complete recovery in two dogs by swabbing the ulcers with a 1% aqueous-alcoholic solution of trypaflavine. Within a few days the spirochetes and fusiform bacteria disappeared and granulation of the ulcer set in. Epithelization was somewhat slower in formation.

Encephalomyelitis in Pigs

The infectious encephalomyelitis of pigs is caused by a filterable virus.[35] The principal source of infection is garbage containing the brain and spinal marrow of diseased animals. Undoubtedly there exists also direct transmission from pig to pig. The incubation period lasts from three to 30 days. The prodromal stage lasts about one to two days. In this stage the pigs exhibit weakness, loss of appetite, vomiting and constipation. The excitatory stage lasts one to two days. The symptoms at this stage are twitching, manege movements, staggering, convulsions, increased sensitivity of skin and muscles, nystagmus, and vomitus. In the paralytic stage the animals are unable to rise, exhibit convulsions and nystagmus. The mortality is 70% of the animals affected. Pigs weighing less than 60 pounds have a better chance for recovery than heavier animals. On post-mortem examination one finds pneumonic areas scattered over the entire lung surface. The mucosa of the stomach is swollen, partly corrugated and hyperemic. The mucosa of the intestine is likewise hyperemic and exhibits numerous longitudinal folds. Subcutaneous injections of a colloidal hydroxide emulsion are recommended for treatment and prophylaxis.

Arthritis Deformans in Horses

Arthritis deformans is seen in colts two to four months old. The disease occurs also in horses one year old and older.[36] This lameness is due to a recessive character possessed by one of the parents, and is therefore of hereditary origin. The disease can be combated only by a suitable breeding program: that is, by eliminating stallions and mares, known to be hereditarily affected, from breeding; avoiding in-and-in breeding and line breeding within the affected families and lines. Although arthritis deformans is incurable, occasionally some horses affected with this ailment improve sufficiently to be used for work, but they should never be used for breeding.

Thrombosis of the Iliac Artery

Thrombosis of the iliac artery is an incurable disease with a long duration.[37] This condition is probably brought about by an injury to the endothelium of the vessel wall. The damage may have been caused either by microbes or parasites or by chemical action. The arteriosclerosis observed in the case under discussion was due, possibly, to the action of the various heart stimulants given. The latter exerted a certain

[33] Berge, E., 1938. Retention Cysts of the Salivary Glands in Dogs. (Trans. title). *Wien. Tierärztl. Monatsschr.* 25(19):585-598.
[34] Gratzl, E., 1938. Trypaflavine in the Treatment of Noma in Dogs. (Trans. title). *Wien. Tierärztl. Monatsschr.* 25(15):497-502.
[35] Rumpl, L., 1939. Enzoötic Encephalomyelitis in Pigs. (Transl. title). *Wien. Tierärztl. Monatsschr.* 26(1):1-6.
[36] Schäper, W., 1939. Arthritis Deformans in Horses. (Transl. title). *Tierärztl. Rundschau* 45(1):7-9.
[37] Udriski, G., 1938. Thrombosis of the iliac artery in the horse. (Transl. title). *Wien. Tierärztl. Monatsschr.* 25(15):457-469.

action upon the vessel wall and the blood plasma, causing formation of fibrin which was, finally, deposited in the iliac artery, resulting in the formation of the thrombus.

Vaccination against Foot-and-Mouth Disease

The technique of preparation of the vaccine is given as follows:—cattle are infected intradermally in the tongue with highly virulent material and after 24 hours the vesicle covering and contents are carefully collected under narcosis.[38] The average yield of material from each animal is 30cc. The material is then ground up in an electric Lapatie apparatus for one hour, diluted to a strength of 7% in distilled water, centrifuged and filtered. Then a mixture is prepared of 50 litres of Wildstätter and Schmidt's aluminum hydroxide, 10 litres of the filtered virus suspension, 40 litres of glycocoll buffer of a concentration to ensure a final pH of 9.0, and lastly 50cc of Schering's formalin. This mixture is stirred for one hour in a special large air-tight electric mixer and finally decanted into one-litre bottles.

The bottles are placed in an incubator (25°C.) for 48 hours, then transferred to cold storage (3-5°C.) where they remain pending tests and dispatch. The dose for cattle is 15-60cc, according to weight. The vaccine is tested on experimental cattle kept in careful isolation which, after inoculation, are shut up for seven days, not even the attendant having contact; the animals are then observed for the nature of the reaction set up, again shut up for seven days, and then tested for immunity by rubbing the tongue with a cloth soaked in virus. If they do not react within seven days the vaccine is issued for field use.

This vaccine has been used on 150,000 cattle with great success. Immunity is evident from the fourth or fifth day and lasts for 4-5 months as far as is at present known. It is claimed that vaccinated cattle possess an almost complete resistance to natural infection.

[38] Waldmann, O., 1938. The Riems Vaccine against Foot-and-Mouth Disease. (Transl. title). *Dtsch. tierärztl. Wschr.* 46:569. Abst. by J. E. in *The Vet. Bul.* 9:1.

Treatment of Nymphomania with Pineal Extract

Latteur[40] distinguished four types of nymphomania: the psychic, caused by continued proximity to a male animal; the hypo-B, associated with hypoluteinism, in which the periods of heat are too frequent and too prolonged; the hyper A associated with a hyperfollicular syndrome, in which cysts are present and there is vagotonia; and the hyper A associated with a hyperthyroid condition, which also exhibits cysts, but in which the general condition because of the hyperthyroidism is much more serious. He treated with pineal extract one cow and two mares of the psychic type, one mare of the hypo-B type, six mares and five cows of the hyper A (hyperfollicular) type, and two cows of the hyper A (hyperthyroid) type, with excellent results, concluding that pineal extract is both efficient and safe in treating all types of nymphomania.

Previous to using pineal extract Latteur used the common method of rupturing the cysts in the hyper A (hyperfollicular) type of nymphomania with the usual result—recurrence of the cysts, and at most only temporary alleviation of the nymphomania. The cysts were not ruptured in the cases treated with pineal extract. They however disappeared promptly.

The author notes that in the hyper A hyperthyroid type the hyperthyroidism was not cured by the pineal extract. This was treated by thyroidectomy after relief of the nymphomania.

Anthrax, sheep and cattle scabies, Bang's, erysipelas, hog cholera, tuberculosis and other contagious diseases can not be successfully controlled without well trained and experienced veterinarians. Contagious diseases and many other ailments have taken a heavy toll from producers, and they demand the attention of experienced animal disease men.—*Live Stock San. Com.*, Sioux City, Iowa.

[40] Latteur, J. P., 1938. A Contribution to the Study of Nymphomania. *Ann. de Med. Vet.*, Dec. 1938, pp. 524-532.